FIVE-YEAR REVIEW REPORT

Wyckoff/Eagle Harbor
Superfund Site
Bainbridge Island, Washington

September 2002

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LIST OF ACRONYMS AND ABBREVIATIONS

ABC	Association of Bainbridge Communities
AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Standard
ASIL	Acceptable Source Impacts Level
ASTM	American Society for Testing and Materials
ATB	asphalt-treated base
bgs	below ground surface
BMP	Best Management Practices
BNA	base/neutral and acid extractable
CDF	Confined Disposal Facility
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIC	Community Involvement Coordinator
CLARC	Cleanup Levels and Risk Calculations
COC	Chemical of Concern
CY	cubic yards
DAF	Dissolved Air Flotation
DNAPL	Dense Non-Aqueous Phase Liquid
DNR	Washington State Department of Natural Resources
DOT	Washington State Department of Transportation
DTS	Distributed Temperature Sensors
DW	Dangerous Waste
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ERA	Expedited Response Action
ESA	Endangered Species Act
FS	Feasibility Study
gpm	gallons per minute

HAET	High Apparent Effects Threshold
HDPE	High Density Polyethylene
HHRA	Human Health Risk Assessment
HPAH	High Molecular Weight Polycyclic Aromatic Hydrocarbon
HPO	Hydrous/Pyrolysis/Oxidation

LIST OF ACRONYMS AND ABBREVIATIONS

(Continued)

IAG	Interagency Agreement
ICP	Institutional Controls Plan
ITTAP	In-situ Thermal Technologies Advisory Panel
IRIS	Integrated Risk Information System
LNAPL	Light Non-Aqueous Phase Liquid
LPAH	Low Molecular Weight Polycyclic Aromatic Hydrocarbon
LS/PA	Log Storage/Peeler Area
MCL	Maximum Contaminant Level
MCUL	Minimum Cleanup Level
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MLLW	Mean lower low water
MTCA	Model Toxics Control Act
NA	Not Applicable
NAPL	Non-Aqueous Phase Liquid
NCP	National Contingency Plan
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollution Discharge Elimination System
NPL	National Priorities List
NRRB	National Remedy Review Board
O&M	Operation and Maintenance
OMMP	Operations, Maintenance, and Monitoring Plan
OMI	Operations and Maintenance International
OU	Operable Unit

PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PCC	Pollution Control Commission
PCP	Pentachlorophenol
ppb	parts per billion
PPE	personal protective equipment
ppm	parts per million
PRP	potentially responsible party
PSAPCA	Puget Sound Air Pollution Control Agency
PSDDA	Puget Sound Dredged Disposal Analysis

LIST OF ACRONYMS AND ABBREVIATIONS
(Continued)

PSEP	Puget Sound Estuary Program
PSR	Pacific Sound Resources
PV	pore volume
PVC	polyvinyl chloride
RAGS	Risk Assessment Guidance for Superfund
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
ROD	Record of Decision
RPM	Remedial Project Manager
SARA	Superfund Amendments and Reauthorization Act
SMS	Sediment Management Standards
SQS	Sediment Quality Standards
SSC	Superfund State Contract
TDS	total dissolved solids
TOC	total organic carbon
TPAH	Total Polycyclic Aromatic Hydrocarbon
TSDF	Treatment, Storage and Disposal Facility
UAO	Unilateral Administrative Order
USACE	U.S. Army Corps of Engineers

U.S.C	United States Code
VOC	Volatile Organic Compound
WAC	Washington Administrative Code
WDFW	Washington State Department of Fish and Wildlife
WHOU	West Harbor Operable Unit
WQS	Water Quality Standards
µg/kg	micrograms per kilogram
µg/L	micrograms per liter

EXECUTIVE SUMMARY

The Wyckoff/Eagle Harbor Superfund Site is located on the east side of Bainbridge Island, in central Puget Sound, Washington. The site includes a former wood-treating facility, called the Wyckoff facility, contaminated sediments in adjacent Eagle Harbor, and other upland sources of contamination to the harbor, including a former shipyard. The site is divided into four operable units (OUs): West Harbor, East Harbor, and the Soil and Groundwater of the Wyckoff facility.

The remedies for each of the operable units include the following:

West Harbor Operable Unit - Evaluation and control of upland sources of contamination, excavation and upland disposal of mercury-contaminated sediments, and placement of clean sediment cap over areas of concern. The September 1992 Record of Decision (ROD) was amended in December 1995 to include construction of a nearshore fill and confined disposal facility in intertidal areas adjacent to the former shipyard property to hold hotspot sediments, and implementation of contaminant source control measures at the former shipyard property to prevent soil contaminants from entering Eagle Harbor through groundwater seeps or surface water runoff. The trigger for this five-year review was the actual start of West Harbor OU remedy construction in April 1997.

East Harbor Operable Unit - In 1993 and 1994, EPA placed clean sediments over a 54-acre hotspot area as part of a non-time-critical removal action. The September 1994 ROD called for monitoring and maintaining the existing sediment cap and capping remaining subtidal areas of concern, monitoring the success of natural recovery in intertidal areas, enhancing existing institutional controls to reduce public exposure to contaminated fish and shellfish, and demolishing in-water structures.

Soil & Groundwater Operable Units - An interim ROD was issued in September 1994 for the Groundwater OU which focused on the actions necessary to contain contaminated groundwater to the Wyckoff site, i.e., replace the existing treatment plant, maintain and upgrade the extraction system, install a physical barrier, and seal on-site drinking water wells that could act as conduits for migration of contaminants to deeper aquifers.

In February 2000, EPA issued a final ROD for the Soil and Groundwater OUs conditionally selecting thermal remediation (i.e., steam injection) as the cleanup remedy. This remedy included constructing a sheet pile wall around the highly contaminated Former Process Area, conducting a pilot study to test the effectiveness of steam injection,

consolidating contaminated soil from outside to within the Former Process Area, monitoring the lower aquifer groundwater, and implementing institutional controls. If the steam injection pilot study does not meet performance goals, then the contingency of site containment will be implemented. The containment remedy would consist of a surface soil cap over the Former Process Area, containment of contaminated groundwater and NAPL with a sheet pile wall and extraction system, and construction of a replacement treatment plant for ongoing treatment of contaminated groundwater.

This five-year review found that where the remedial actions have been constructed for West Harbor, East Harbor, Soil, and Groundwater OUs, the work was done in accordance with the requirements of the Records of Decision. The soil and upper aquifer groundwater within the Former Process Area and the East Beach intertidal area remain contaminated and will continue to be addressed by EPA. However, the constructed remedies are functioning as designed. Some issues remain and follow-up actions will have to be implemented to ensure ongoing protectiveness of human health and the environment (see Five-Year Review Summary Form, below). The immediate threats have been addressed. EPA will continue to monitor the remedies that are in place, monitor the East Beach, and continue to operate the steam injection pilot project, as well as the site-wide groundwater treatment plant and extraction system.

Wyckoff/Eagle Harbor Superfund Site
Bainbridge Island, Washington
First Five-Year Review Report

I. INTRODUCTION

Purpose of the Review

The purpose of five-year reviews is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in Five-Year Review reports. In addition, Five-Year Review reports identify issues found during the review, if any, and recommendations to address them.

Authority for Conducting the Five-Year Review

The U.S. Environmental Protection Agency (EPA) prepared this five-year review pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) §121 and the National Contingency Plan (NCP). CERCLA §121 states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgement of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

EPA interpreted this requirement further in the NCP; 40 CFR §300.430(f)(4)(ii) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants*

remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.

Who Conducted the Five-Year Review

EPA Region 10 has conducted a five-year review of the remedial actions implemented at the Wyckoff/Eagle Harbor Superfund site on Bainbridge Island, Washington. This review was conducted for the entire site from March 2002 through September 2002. This report documents the results of the review.

The U.S. Army Corps of Engineers (USACE) and CH2M Hill provided support to EPA in the data analysis and evaluation of remedy protectiveness for this five-year review. The USACE also conducted the site inspection on behalf of EPA.

Other Review Characteristics

This is the first five-year review for the Wyckoff/Eagle Harbor Superfund site. The triggering action for this review was the actual start of construction for the West Harbor Operable Unit in April 1997. The five-year review is required due to the fact that hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure.

II. SITE CHRONOLOGY

Event	Date
Pollution Control Commission (PCC) reported direct discharge of oily material from the wood-treating facility to Puget Sound; oil observed on beach adjacent to the facility.	December 1952
EPA began investigating the property due to reports of oil observed on the beach adjacent to the Wyckoff property.	1971
EPA and the Washington Department of Ecology (Ecology) reported oil seepage to Eagle Harbor and required Wyckoff Company to take immediate action to determine the source and reduce or eliminate seepage.	April 1972

U.S. Coast Guard issued Notice of Violation for oil discharge from the facility to Puget Sound.	May 1975
The National Oceanic and Atmospheric Administration (NOAA) advised EPA and Ecology that samples of sediments, fish, and shellfish from Eagle Harbor contained elevated levels of polycyclic aromatic hydrocarbons (PAHs) in both sediments and biota.	March 1984
EPA issued a Unilateral Administrative Order (UAO) requiring the Wyckoff Company to conduct environmental investigation activities under the Resource Conservation and Recovery Act (RCRA) Section 3013 (42 U.S.C. §6924), and Ecology issued an Order requiring immediate action to control stormwater runoff and seepage contaminants. Data collected at the time revealed the presence of significant soil and groundwater contamination.	August 1984
The Wyckoff/Eagle Harbor Superfund site was proposed for listing on the National Priorities List (NPL).	September 1985
NOAA completed a study relating the presence of Polycyclic Aromatic Hydrocarbons (PAHs) in sediment to the high rate of liver lesions in English Sole from Eagle Harbor.	1985
The Wyckoff Company entered into an Administrative Order on Consent (AOC) with EPA for further investigation of the wood treatment facility.	March 1987
The site was added to the NPL.	July 1987
Under an AOC, the Wyckoff Company agreed to conduct an Expedited Response Action (ERA). The ERA, intended to minimize releases of oil and contaminated groundwater to Eagle Harbor, called for a groundwater extraction and treatment system and other source control measures.	July 1988
Wyckoff Company ceased wood-preserving operations	December 1988
Completed Remedial Investigation (RI) for Eagle Harbor	November 1989
Groundwater extraction and treatment system began at selected wells	January 1990

EPA issued a UAO requiring the Wyckoff Company (renamed and currently known as Pacific Sound Resources, Inc.) to continue the ERA with enhancements. The UAO called for increased groundwater extraction and treatment rates, improved system monitoring, and removal of sludge stored or buried at the Wyckoff facility.	June 1991
Completed Feasibility Study (FS) for Eagle Harbor	November 1991
EPA conducted a time-critical removal action at the Wyckoff facility: Removed approximately 29,000 tons of creosote sludges; disposed of 100,000 gallons of contaminated oils; disposed 430 cubic yards of asbestos; installed 300 feet of steel sheetpiling; repaired and constructed 150 feet of bulkhead; recycled 660 long tons of steel from retorts, tanks, and other on-site steel.	June 1992 - April 1994
Record of Decision (ROD) was signed for West Harbor Operable Unit. The selected remedy called for: (1) Evaluation and control of upland sources of contamination; (2) excavation and upland disposal of mercury-contaminated sediments; (3) placement of clean sediment cap over areas of concern.	September 1992
EPA placed approximately 209,000 cubic meters of clean sediment materials over a 54-acre area of contaminated sediments in Eagle Harbor.	September 1993 - March 1994
EPA assumed responsibility for operation and maintenance (O&M) of the groundwater extraction and treatment system because the company was financially unable to do so.	November 1993
Administrative Order on Consent for Remedial Design for the West Harbor OU issued to PACCAR Inc., Washington State Department of Transportation (DOT), and Bainbridge Marine Services.	November 1993
A time-critical removal action was conducted at the groundwater extraction system and treatment plant to repair/replace failing equipment, upgrade system parts, and clean-out of system units.	May - December 1994
Pacific Sound Resources, Inc., and their principals settled their CERCLA liability with EPA and the federal and tribal natural resource trustees in a Consent Decree.	August 1994
Completed Focused RI/FS for the Groundwater Operable Unit.	July 1994

EPA issued Interim ROD for the Groundwater Operable Unit, which included the following elements: (1) Replace the existing treatment plant; (2) evaluate, maintain, and upgrade the existing extraction system; (3) install a physical barrier, i.e., a slurry wall to prevent further releases of contaminants to Eagle Harbor and Puget Sound; (4) seal on-site wells.	September 1994
EPA completed the ROD for the East Harbor Operable Unit, which included the following elements: (1) Monitor and maintain existing sediment cap; additional capping in remaining subtidal areas of concern; (2) monitor the success of natural recovery in intertidal areas; (3) enhance existing institutional controls to reduce public exposure to contaminated fish and shellfish; (4) demolish in-water structures.	September 1994
Signed Superfund State Contract (SSC) with the Washington Department of Ecology for Groundwater OU Interim Remedial Action.	November 1994
RI Field Investigations for the Soil and Groundwater Operable Units	1994 & 1995
EPA sealed and abandoned 12 on-site wells, including two deep drinking water wells, due to concerns that they could provide conduits for migration of contaminants to the deep aquifers.	January - June 1995
Seven original extraction wells were abandoned and replaced by eight new groundwater extraction wells; additional treatment plant upgrades including piping replacement, carbon handling, and installation of dewatering press.	June - December 1995
West Harbor OU ROD Amendment. The amendment included the following changes to the 1992 ROD: (1) Construction of a nearshore fill and confined disposal facility (CDF) in intertidal areas adjacent to the former shipyard property. Hotspot sediments will be placed inside the CDF and capped with clean material and asphalt; (2) implementation of contaminant source control measures at the former shipyard property acquired by DOT, to prevent soil contaminants from entering Eagle Harbor through groundwater seeps or surface water runoff.	December 1995
Non-time critical removal action: Site structures were demolished and debris removed and disposed off-site.	January - June 1996

West Harbor OU potentially responsible parties (PRPs) constructed the remedy at the old shipyard in accordance with the December 1995 ROD Amendment. Upland construction included: (1) soil stabilization of two upland "hot spot" areas; (2) installation of a tidal barrier system adjacent to the landfill located in the northwest corner of the upland area; (3) installation of a cutoff drainage system along the northern boundary of the site to intercept and cutoff surface and shallow subsurface water run-on; and (4) installation of an asphalt concrete cap across the former Bainbridge Marine Services upland. Sediment construction included: (1) removal, treatment, and disposal offsite of DU1 sediments (those that exceeded the Dangerous Waste [DW] criteria); (2) removal and disposal in an on-site confined disposal facility (CDF) of hot spot sediments containing more than 5 mg/kg total mercury; (3) backfill sediment dredge areas to pre-existing grade elevations; (4) placement of a thick cap (1 meter) over sediments containing >2.1 mg/kg mercury; and (5) placement of a thin cap (15 centimeters) over sediments exceeding chemical or biological cleanup standards. In addition, new aquatic habitat was constructed to mitigate loss of 0.9 acres from remedial construction. This new habitat included enhancing the face of the CDF berm face and the surface of the tidal flow barrier and sediment cap with gravel/cobble layers.	March - December 1997
EPA issued a Water Quality Certification for the West Harbor OU remedial work.	April 1997
West Harbor OU PRPs provided the Suquamish Tribe with $110,000 for clam enhancements and other restoration projects performed by the Tribe.	Summer 1997
West Harbor OU PRPs constructed a 2-acre Schel-chelb Estuary at the south shore of Bainbridge Island ("South Bainbridge Estuarine Wetland and Stream Restoration Site") (planting occurred during February through late Spring 1998).	Summer 1997 - Spring 1998
Completed removal of upland subsurface structures, such as process piping, utility lines, foundations, concrete pads, and asphaltic concrete.	November 1997
EPA issued a "final" Proposed Plan which preferred containment as the cleanup strategy for soil and groundwater.	November 1997

Completed design for a replacement treatment plant. The plant was not constructed pending a final decision regarding the Groundwater OU remedy.	July 1998
Long-term O&M associated with the containment strategy were of concern to the Department of Ecology; EPA evaluated thermal technologies for possible application at Wyckoff: Conducted laboratory studies, met several times with the In-situ Thermal Technologies Advisory Panel (ITTAP), evaluated results of various other thermal technologies studies and site demonstrations.	1998 - 1999
Region 10 presented thermal technologies evaluation activities and proposed new remedy for removal of contaminants in the soil and groundwater at Wyckoff to the National Remedy Review Board (NRRB).	July 1998
West Harbor OU PRPs established a 0.6-acre eelgrass planting site immediately west of West Harbor OU CDF and cap.	September - October 1998
Completed Focused Feasibility Study Comparative Analysis of Containment and Thermal Technologies	April 1999
West Harbor OU PRPs repaired 3 feet deep by 2 feet wide by 5 feet long depression that developed in surface of CDF during March - April 1999	June 1999
Completed Conceptual Design for thermal remediation of the Soil and Groundwater OUs.	September 1999
EPA issued a second Proposed Plan for the Wyckoff Soil and Groundwater OUs. This Proposed Plan replaced the November 1997 Proposed Plan and presented a change in the cleanup strategy. EPA's preferred remedy in this plan (now the selected cleanup remedy) focused on an innovative technology, called steam injection, to actively remove contaminants from the soil and groundwater.	September 1999
Completed removal of the West Dock.	December 1999

EPA issued Record of Decision (ROD) for Wyckoff Soil and Groundwater OUs conditionally selecting steam injection as the cleanup remedy. Components of this remedy include: (1) Constructing a sheet pile wall around the highly contaminated zone of the Former Process Area; (2) conducting a pilot study to test the applicability and effectiveness of steam injection; (3) consolidating hot spots from the Former Log Storage/Peeler Area to the Former Process Area; (4) monitoring the lower aquifer groundwater; (5) implementing institutional controls	February 2000
Signed Superfund State Contract (SSC) with the Washington Department of Ecology for Soil and Groundwater OUs.	May 2000
Completed the following construction activities: installed over 1,800 lineal feet of sheet pile containment wall around the Former Process Area; installed 530 lineal feet of sheet pile wall within a 1-acre area of the site for the steam injection pilot study; created 2 acres of habitat beach to mitigate for habitat loss resulting from construction of the outer sheet pile wall; extended the existing sediment cap by an additional 15 acres.	February 2001
Completed the following construction activities: vapor cap over the steam injection pilot area, all 16 injection wells and seven extraction wells, over 600 thermal monitoring devices, boiler building; on-site water well for boiler feed water; removed additional 10,000 cubic yards of contaminated soil (20,000 CY of contaminated soil were removed during habitat beach construction) to complete cleanup of the Former Log Storage/Peeler Area; complete capping in Eagle Harbor - more materials were placed extending out several hundred feet from the Wyckoff property to form a gently sloping beach which connects the habitat beach to the west with existing intertidal areas to the east.	February 2002
Completed the following construction activities: modifications to the existing groundwater treatment plant for treatment of new waste streams extracted from the steam injection pilot area; installation of boiler, water softening equipment, heat exchangers, thermal oxidizer, compressor, injection and extraction pumps and associated conveyance pumps and piping, and other pilot system equipment in the boiler building and within the pilot area; and start-up for all new equipment.	September 2002

III. BACKGROUND

Physical Characteristics

The Wyckoff/Eagle Harbor Superfund site is located on the east side of Bainbridge Island, in central Puget Sound, Washington (Figure 1). The site includes an inactive wood-treating facility, called the Wyckoff facility, contaminated sediments in adjacent Eagle Harbor, and other upland sources of contamination to the harbor, including a former shipyard. The site is currently divided into four operable units (Figure 1).

The harbor supports several fish resources. Coho and chum salmon once used the creek on the north shore to spawn, and fingerlings have been released there periodically. The creek at the head of the harbor is a salmon nursery, and it is possible that the drainage on the south side is used as a chum spawning ground and nursery. Eagle Harbor may also be a spawning ground for surf smelt and Pacific sand lance (Washington Department of Fish and Wildlife, 1992). Other fish and invertebrates present in the harbor include several flat fish species, rockfish, pile perch, cod lingcod, crabs, and shrimp. Several shellfish species are present in intertidal and subtidal areas.

Endangered species of concern for the Wyckoff site and surrounding marine habitats include Puget Sound chinook, bull trout, Stellar sea lion, bald eagle, and marbled murrelet.

Land and Resource Use

Current Land Use

More than 20,000 people live on Bainbridge Island. Land use on Bainbridge Island is principally residential, with some commercial and industrial use. An urban area, formerly the City of Winslow (population 2,800), lies on the north shore of the Harbor. Residences, commercial centers, a city park, several marinas, a Washington State Ferry repair yard, a bulkhead enterprise, and a ferry terminal characterize the northern shoreline. The western and southern shores are primarily lined with residences, farms, marinas, and a boatyard. On the south shore at the harbor mouth, the former wood-treating facility extends into the harbor on fill.

A significant use of the harbor is ferry transport of vehicles and passengers between the City of Bainbridge Island and Seattle. Currently, approximately twenty-four runs are made per day. The harbor is also used for moorage of pleasure boats, house boats, and working boats. Fishing, crabbing, and clam-digging were common recreational activities until 1985, when the Bremerton-Kitsap County Health District issued a health advisory to address bacterial and chemical contamination of seafood in Eagle Harbor. The advisory, recommending against the harvest and

consumption of fish and shellfish, has significantly reduced recreational harvest of seafood from the harbor.

Eagle Harbor is within the usual and accustomed fishing area of the Suquamish Tribe, whose reservation is located on the Kitsap Peninsula north of Bainbridge Island. The Suquamish Tribe retains the right to harvest fish and marine invertebrates and to have fishery resource habitat areas protected within the Suquamish Tribe's usual and accustomed fishing area.

Wood treating operations at the Wyckoff site ceased in 1988. By October 1997, EPA had removed all structures and buildings at the site, with the exception of the existing pump-and-treat system.

The current zoning of the Wyckoff property is Water-Dependent Industrial. Uses under the current zoning may include retail commercial, indoor entertainment, cultural and government facilities, associated parking, agriculture, boatyards, marine sales and repair.

Reasonably Anticipated Future Land Uses

The Wyckoff Superfund Site is scheduled for a comprehensive plan amendment by the City of Bainbridge Island. In 1996, a citizen committee was formed by then mayor, Janet West, to study future land use for the Wyckoff property. A report, entitled *Recommended Zoning for the Site of the Former Wyckoff Creosote Facility, Wyckoff Zoning Advisory Committee* (August 7, 1996), was accepted by the Bainbridge Island City Council. The recommendations were based on the assumptions that the contamination would be contained in place, i.e., the contaminated groundwater would be contained using a slurry wall and the contaminated soil would be capped.

The 1996 Bainbridge Island Zoning Advisory Committee recommendations were:

> Residential Use in the Hillside Area (Approximately 39 acres)
> Single family and multi-family residential.
>
> Mixed-Use Water-Dependent/Water-Related Commercial in the Former Log Storage/Peeler Area (Approximately 10 acres)

Water related commercial uses including marina, boatyard with haul-out facility, marine sales and repair, marine related sales, and restaurants. Emphasis is on water-dependent uses.

Open Space Recreational Uses in the Former Process Area (Approximately 8 acres) Limited to public recreational uses including vegetated areas, pedestrian/bike trails, playgrounds, restroom facilities, recreational shelters, parking and potential museum structure.

Since then, EPA has altered the property's characteristics and has changed the cleanup approach from containment to a more aggressive cleanup of the soil and groundwater using an innovative steam injection technology. It is possible that there will be flexibility in future land uses based on the cleanup that may be achieved, including but not limited to, residential use for large portions of the Wyckoff property.

In 2001, the City re-evaluated the original report and assumptions and made new recommendations to the Planning Commission and City Council as part of the Wyckoff Comprehensive Plan Amendment process. In June 2001, the City issued an updated report to the 1996 Wyckoff Zoning Advisory Report, entitled *Recommended Land Use for the Former Wyckoff Creosote Facility.*

The "Preferred Alternative" from the 2001 report promotes the use of the entire property as public parkland. The City recognizes that public ownership is fundamental to this alternative and is currently pursuing financial and political support for purchase of the property: (See Figures 2 and 3)

North Area - Approximately 42 acres

Point: Approximately 11.5 acres to be developed as active park, retaining views and providing public access to the water.

Flatlands: Approximately 8 acres of waterfront parkland with trail and beach access, protected shoreline habitat and also including development of active public marine related uses, providing a public dock, boathouse and other boating facilities. Consideration should also be given to a cross-harbor foot ferry.

Uplands: Aproximately 22 acres

- West Uplands - A minimum of 2 acres adjacent to Taylor Avenue would be devoted to a Japanese American Memorial in honor of those citizens incarcerated during World War II. Vehicular access to the Wyckoff

property on the western boundary of the site would be limited to provide a buffer between the active uses and the memorial.

- Ravine - This area would primarily serve as a natural wildlife corridor connecting to the habitat beach.
- East Uplands - The main vehicular entrance to the park, parking and service uses would be sited here, including buildings serving as interpretive, educational, historical or cultural centers.
- Trail - A trail link through the Uplands would connect to Eagle Harbor, the Uplands, the Japanese American Memorial, the Point and the marine activities along the shoreline.

South Area - Approximately 7.5 acres left undeveloped to serve as a buffer between the park and existing residential neighborhoods.

Reasonably Anticipated Future Resource Uses

In 2001, EPA created over two acres (approximately 1,200 lineal feet) of new beach habitat on the western portion of the site significantly enhancing the habitat and ecosystem function at the Wyckoff site. The beach mitigates for the habitat lost by the offshore construction of the sheet pile wall. Construction of the habitat area involved removing old bulkheads, removing a total of 40,000 cubic yards of soil, and contouring soil along the shoreline. A layer of "fish mix", or material with the grain size preferred by salmon and smelt, was placed on the newly created beach. Creation of the mitigation beach, combined with the new intertidal habitat resulting from the completion of the sediment capping, restored approximately 2,500 feet of clean interconnected beach habitat for endangered species - including Chinook salmon and bull trout - smelt, shellfish, birds and small mammals. In late 2001, additional beach material was placed over the rip rap at the top of the habitat beach to improve overall habitat function. EPA also planted over 2,000 native trees, shrubs, plants and grasses in a 20-foot habitat buffer extending from the top of the beach inland.

EPA is considering the potential for a vegetated buffer along the entire Wyckoff shoreline after cleanup is complete to protect the intertidal and subtidal remedy and to support and protect functions of nearshore habitat. A healthy native riparian zone or buffer provides woody debris, cover, and insects to the upper beach for juvenile salmonids. This buffer would also be intended to separate critical habitat from nearby development and human activity. Buffers reduce impacts from stormwater runoff by stabilizing soils, providing erosion control, and filtering suspended solids. The buffer would also provide essential habitat for upland shoreline wildlife for use in feeding, breeding and rearing, as well as necessary cover from predators.

In March 2001, EPA solicited comments from the public on the potential use of vegetated buffer areas along the Wyckoff shoreline after cleanup. EPA received favorable responses regarding buffer zones at the site including resolutions from the Bainbridge Island City Council and the Bainbridge Island Park & Recreation District. EPA also received correspondence from the Suquamish Tribe, the National Marine Fisheries Services of NOAA, the U.S. Fish and Wildlife Service, and the Washington State Department of Fish and Wildlife calling for and advocating the creation of buffer zones at The Wyckoff site. EPA is currently in the process of drafting a Preliminary Institutional Controls Plan (ICP) detailing performance standards that must be met by the landowner under local control and oversight, to protect the intertidal and subtidal areas, which are part of the site's cleanup remedy.

Future resource uses of Eagle Harbor and the Washington State Department of Transportation (DOT) ferry terminal is anticipated to remain the same. The No Anchor Zone, established by EPA, the Washington State Department of Natural Resources (DNR), and the U.S. Coast Guard, to protect the subtidal cap in Eagle Harbor will be maintained.

Groundwater Classification and Basis

Both Class II and Class III groundwater exist at Wyckoff (EPA Guidelines for Ground-Water Classification, Final Draft, December 1986). Class III groundwater occurs where saltwater intrusion raises total dissolved solids (TDS) concentrations above 10,000 mg/L. Class II groundwater occurs above and upgradient of the 10,000 mg/L boundary. (see Figure 4)

Upper Aquifer. Groundwater in the upper aquifer underneath the Former Process Area is not currently extracted for potable, agricultural, or industrial purposes, due to saltwater intrusion caused by tidal flushing. High salinity levels are anticipated to remain in the future. The Washington State Department of Ecology has determined the upper aquifer groundwater in the Former Process Area to be non-potable because it is significantly affected by salinity and will not be used as a future source of drinking water. The assignment of Class III to the upper aquifer groundwater beneath the Former Process Area is consistent with EPA's definition of a potential source of drinking water.

The upper aquifer beneath the Former Log Storage/Peeler Area does not serve as a current source of drinking water. However, this aquifer could potentially be potable.

Lower and Deep Aquifers. The upper groundwater aquifer is separated from the lower aquifer by a low-permeability layer (aquitard). Data gathered during the remedial investigation and during exploratory drilling by the U.S. Army Corps of Engineers

indicate that the low-permeability layer is continuous with thickness generally ranging from 10 to 40 feet, although it may be as thin as four feet in isolated locations and/or may contain interbedded sand layers.

Groundwater in the lower aquifer (approximately 80 to 200 feet below ground surface) is considered potable although this aquifer has never been used for drinking water on this property.

Additionally, there are deep confined aquifers that are located from approximately 200 feet to 1,500 feet or more below ground surface. These aquifers are also potable and were used in the past by the Wyckoff Company to provide water for on-site operations with excess sent to nearby residents on Rockaway Beach to be used for drinking water purposes. EPA sealed and abandoned two deep drinking water wells (located at 500 feet and 800 feet bgs) in 1995 due to concerns that they could provide conduits for migration of contaminants to the deep aquifers.

Current Groundwater Use

Two community drinking-water supply systems are located in the immediate vicinity of the Wyckoff property: the Bill Point wells and the South Eagle Harbor Supply Well. The Bill Point Wells are located upgradient on the hillside south of the Wyckoff property; drinking water is obtained from two to four wells that are each completed at depths of 150 to 160 feet below ground surface (bgs). Quarterly sampling was conducted from 1988 to 1994 at these wells to determine if they were impacted by the Wyckoff operations. An assessment of the analytical results indicated that some extremely low levels of organics existed in these wells, however, concentrations were extremely low, and in most cases several orders of magnitude below the most stringent drinking water levels. Several inorganic chemicals (metals) have also been detected. However, metals have not been used at the Wyckoff facility as part of wood-preserving operations. Furthermore, the Bill Point wells are also located upgradient of the contamination at Wyckoff, and there is no interconnection between the Bill Point aquifers and the upper (contaminated) aquifer beneath the Wyckoff site. Therefore, EPA ceased the sampling program in 1994. The South Eagle Harbor Supply Well is located about one-half mile west of the Wyckoff property and is completed at a depth of approximately 600 feet bgs. This well was constructed to provide a replacement water supply for the Rockaway Beach community.

In January 2002, EPA completed construction and testing of an on-site water supply well. This well was constructed outside of the contaminated zone on the Wyckoff property (Figure 5). The purpose of the well is to provide a water source for conversion to steam in the boiler during the

steam injection pilot project and for other site operation uses. The water well was completed within an aquifer system between the depths of 460 and 500 feet below ground surface (bgs). During construction of the well, necessary casing reductions occurred only within low-permeability zones (i.e., aquitards) to prevent communication between the aquifers and to protect the deep aquifers.

Pump test results show that the on-site water supply well can provide 200 gallons per minute (gpm) with very minimal or no effect on nearby water supply systems. EPA monitored the Bill Point water supply system and the City's South Eagle Harbor well located on Taylor Avenue during the pumping test. Salinity measurements during the pump test indicated there was no seawater intrusion in the on-site water supply well. No exceedances of drinking water criteria were noted in the water supply well, nor were contaminants associated with the site detected in either the South Eagle Harbor or Bill Point wells.

History of Contamination

From the early 1900s through 1988, a succession of companies treated wood at the Wyckoff property for use as railroad ties and trestles, telephone poles, pilings, docks, and piers. Initially the poles were treated by wrapping with burlap and asphalt, but by 1910 pressure treatment began with creosote/bunker oil. The Wyckoff wood-preserving plant was one of largest in the United States, and its products were sold throughout the nation and the rest of the world. Wood-preserving operations included: (1) the use and storage of creosote, pentachlorophenol, solvents, gasoline, antifreeze, fuel and waste oil, and lubricants; (2) management of process wastes; (3) wastewater treatment and discharge; and (4) storage of treated wood and wood products.

The main features of the wood-treating operation included: (1) a process area, which included numerous storage tanks and process vessels such as retorts; (2) a log storage and log peeler area; and (3) a treated log storage area.

There is little historic information about the waste management practices at the Wyckoff facility. Prior to reconstruction of the Wyckoff facility in the 1920s, it is reported that logs were floated in and out of a lagoon that once existed at the site. The lagoon has since been filled. Treated logs were also transported to and from the facility at the former West Dock via a transfer table pit, and the chemical solution that drained from the retorts after a treating cycle went directly on the ground and seeped into the soil and groundwater below the surface. This practice began around the mid-1940s until operations ceased in 1988. Wastewater was also discharged into Eagle Harbor for many years, and the practice of storing treated pilings and timber in the water continued until the late 1940s. Further site contamination occurred due to drips from treated

poles and sloppy handling of used treatment product. The log storage area was primarily used to store untreated wood.

Groundwater and soils at the wood-treating facility are contaminated with chemicals from the wood treatment process, primarily creosote-derived polycyclic aromatic hydrocarbons (PAHs), pentachlorophenol (PCP), aromatic carrier oils, and dioxins/furans. Over the last 12 years of operating the on-site extraction system and treatment plant, EPA has removed approximately 100,000 gallons of non-aqueous phase liquids (NAPL) from the ground and treated over 370 million gallons of contaminated groundwater. It is estimated that 1 million gallons of NAPL still remain in the subsurface.

Sediments in areas of Eagle Harbor are contaminated with PAHs and other organic compounds, as well as with metals, primarily mercury. The wood treating facility is the major source of PAH to the East Harbor through both past operating practices and contaminant transport through the subsurface. An additional source of contaminants to Eagle Harbor was created when sludge from tanks and sumps was used as fill material between an old and new bulkhead at the Wyckoff site in the 1950s. In the West Harbor, PAH contamination in nearshore sediments appear to be from combustion products, minor spills, and pilings and piers, while subtidal PAH contamination in the West Harbor is believed to reflect a combination of these sources, disposal practices at the former shipyard (Figure 1), and releases from the Wyckoff property. Elevated concentrations of metals, particularly near the former shipyard, are associated with past shipyard operations, including the application, use, and removal (by sandblasting) of bottom paints and antifoulants.

Initial Response

Due to reports of oil observed on the beach, EPA began investigating the property in 1971. In 1984, EPA issued an order requiring the Wyckoff Company to conduct environmental investigations. Data collected at the time revealed the presence of significant soil and groundwater contamination. Numerous other investigations were conducted at this site prior to initiation of the RI/FS. The Wyckoff Company, EPA, the Washington Department of Ecology (Ecology), and the National Oceanic and Atmospheric Administration (NOAA) all investigated other aspects of the site in the early to mid-1980s under regulatory authority other than Comprehensive Environmental Response Compensation and Liability Act (CERCLA) authority. Although work was conducted under Resource Recovery and Conservation Act (RCRA) authority, the site was not considered a treatment, storage and disposal facility (TSDF).

The site, including Eagle Harbor, the wood-treating facility, and other sources of contamination to Eagle Harbor, was listed on the Superfund National Priorities List (NPL) in July 1987. In July

1988, the Wyckoff Company was ordered by EPA to install groundwater extraction wells and a groundwater treatment plant in an effort to halt continuing release of wood-treating contaminants to Eagle Harbor.

A settlement with the Wyckoff Company was embodied in a Consent Decree entered in Federal District Court in August 1994. The Decree creates the Pacific Sound Resources (PSR) Environmental Trust into which the heirs of the Wyckoff Company founders, owners and operators placed all ownership rights and shares in the Company to allow the Trust to maximize liquidation of all company assets, including nonwood-treating holdings, for the benefit of the environment. The beneficiaries of the Trust are the United States Department of Interior, National Oceanic and Atmospheric Administration (NOAA) of the Department of Commerce, and the Suquamish and Muckleshoot Tribes, as Natural Resource Trustees, as well as EPA (the Superfund trust fund) for reimbursement of CERCLA remedial costs. A memorandum of agreement was entered into by the beneficiaries of the Trust to ensure that settlement proceeds would be applied toward both environmental response and natural resource restoration goals.

The groundwater pump-and-treat systems were put online in 1990. In November 1993, EPA assumed control of the site and operation of the systems and discovered that both the treatment plant and extraction systems were in a state of disrepair. New extraction wells were installed to replace the original seven and a variety of operational and process improvements were made to the treatment system.

The systems have been effective in recovering large amounts of oily creosote in the form of non-aqueous phase liquid, or NAPL, and in helping to control the migration of contaminants from the groundwater to the Harbor. The extracted groundwater contaminated with elevated levels of PAHs and PCP is treated at the plant so it can be safely discharged through an outfall to Puget Sound.

Other actions taken to deal with the contamination include demolition and removal of the buildings, structures, above ground and underground storage tanks, underground foundations and piping, and the removal of asbestos, sludge, and some heavily contaminated soil. In the East Harbor, a 54-acre sediment cap was placed over contaminated subtidal sediments in 1993 and 1994.

Basis for Taking Action

<u>West Harbor Operable Unit</u>

Intertidal samples from Eagle Harbor were found to exceed the maximum concentrations measured at background locations for a number of metals (copper, lead, zinc, cadmium, and arsenic). The greatest number of metals detected and the highest concentrations were detected near the former shipyard on the north shore. Subtidal mercury concentrations exceeded maximum background values by between two and twenty times throughout the harbor and were particularly high near the former shipyard.

PAH concentrations were extremely high in intertidal sediments adjacent to the Wyckoff facility (East Harbor OU) and, to a lesser extent, near the ferry terminal (West Harbor OU). Sediment PAH concentrations adjacent to the former shipyard in the West Harbor were lower, but were still higher than at intertidal background stations. Subtidal samples showed heavy PAH contamination in the East Harbor, with several high values near the former shipyards in the West Harbor. Estimated average concentrations of HPAH, the high molecular weight subgroup of PAH compounds, were highest north of the Wyckoff facility and in the central harbor, and were significantly higher than background values. Concentrations of total PAH (TPAH) and low molecular weight PAH (LPAH) follow the same general pattern. Contamination by pentachlorophenol is not widespread.

Human populations potentially exposed to contamination include children and adults who consume contaminated fish and/or shellfish, and individuals, particularly children, who might be exposed to contaminated intertidal sediments through dermal exposure (skin contact) or incidental ingestion. Risks from four exposure routes were calculated, including ingestion of contaminated clams and crabs, ingestion of contaminated fish, ingestion of contaminated intertidal sediments, and dermal contact with contaminated intertidal sediments. Marine organisms potentially exposed to contaminated sediments include sediment-dwelling organisms in three major taxonomic groups: mollusca (e.g., clams), polychaeta (worms), and crustacea (e.g., amphipods).

Human health risks for Eagle Harbor are primarily associated with the consumption of shellfish. The Eagle Harbor human health risk assessment used a high (95th percentile) fish and shellfish ingestion rate, computed from the 1988 Puget Sound Estuary Program (PSEP) study of seafood consumption in Puget Sound. The high rate for shellfish consumption was estimated to be 21.5 grams per day, equivalent to a 1/3-pound serving a week. The fish consumption rate was 95.1 grams/day for fish. This rate corresponds to 230 servings of 1/3-pound of fish over the course of a year. (The study estimated that an average consumer eats at most 30 such servings of fish and three such servings of shellfish per year). The high rates were used for the reasonable maximum exposure (RME) assumption for adults. These assumptions were modified to develop ingestion rates for children, based on body weight ratios.

In the West Harbor, the cancer risks in the 10^{-3} range were associated with clam tissues from areas near the ferry terminal and the former shipyard.

East Harbor Operable Unit

Chemical concentrations in Eagle Harbor sediments and seafood were elevated with respect to background locations. However, human health risk estimates for exposure to sediment contaminants through dermal contact and sediment ingestion are within or below EPA's range of acceptable risks (EPA's acceptable risk range is from 1 in 10,000 ($1x10^{-4}$) to 1 in 1,000,000 ($1x10^{-6}$)). For seafood ingestion, calculated cancer risks are generally between 10^{-4} and 10^{-6} at both Eagle Harbor and background locations. Consumption of shellfish from specific areas (such as near the Wyckoff property) results in risk above 10^{-4}.

The bioassays for acute toxicity indicated that sediments from many sampled locations in the East Harbor were toxic to amphipods, oyster larvae, or both. The bioassay responses were most severe in areas of high PAH contamination, such as areas of the East Harbor north of the Wyckoff facility. Additional evidence of biological effects in Eagle Harbor includes the prevalence of liver lesions and tumor in English sole, as documented by NOAA. This and laboratory research citing the effects of PAH and other sediment contaminants on marine organisms add to the evidence suggesting potential damage to Eagle Harbor marine life. Table 1 summarizes the baseline risk (i.e., health risk prior to any cleanup activities) adjacent to the Wyckoff property.

Soil Operable Unit

The Soil OU is divided into three components, the Former Log Storage/Peeler Area, the Former Process Area, and Well CW01 Area (Figure 6). There is widespread near-surface and subsurface soil contamination in these areas, with very elevated levels of contamination in the Former Process Area. The contaminants of concern (COCs) in soil are nine PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b&k)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and naphthalene), pentachlorophenol, and dioxins/furans. The primary contributor to cancer risk through soil ingestion by future residents (the residential exposure scenario was evaluated in the baseline human health risk assessment) is benzo(a)pyrene, a carcinogenic PAH. The remaining carcinogenic high molecular weight PAHs, or HPAHs, PCP, and dioxins make up the rest. The primary contributor to non-cancer risk is naphthalene with a calculated hazard quotient of 22.8. Table 2 summarizes the average exposure, maximum exposure concentration, and associated risk values for chemicals of concern in the Soil OU.

Groundwater Operable Unit

The Groundwater Operable Unit includes the soil and groundwater in the saturated zone beneath the Soil Operable Unit (Figure 6). The Groundwater OU is composed of two water-bearing zones separated by a layer of low-permeability material, called the aquitard. These water-bearing zones (i.e., the upper and lower aquifers) consist of sand and gravel with variable amounts of silt. The aquitard is comprised of stiff marine silt and dense to hard glacial material. The aquitard is continuous throughout the site; its thickness varies from 10 feet to 40 feet, but may be as thin as four feet in isolated areas, and in some locations, contain interbedded sand layers.

In the development of cleanup alternatives, the Groundwater OU was divided into three areas: the upper aquifer beneath the Former Process Area, the upper aquifer beneath the Former Log Storage/Peeler Area, and the lower aquifer (Figure 6).

Light non-aqueous phase liquid (LNAPL) "pools" have been located in the upper aquifer beneath the Former Process Area at maximum thicknesses up to 13 feet. Dense non-aqueous phase liquid (DNAPL) "pools" have been measured at maximum thicknesses up to 14 feet. Prior to installation of the sheet pile wall in 2001, seeps of NAPL into the intertidal area were observed along the eastern and northern shoreline. The seeps appeared to coincide with observations of LNAPL in groundwater on-site. DNAPL pools were observed (and periodically removed by divers) on the harbor floor in the Log Rafting Area west of the large dock (former West Dock). L- and DNAPL are present everywhere in the upper aquifer groundwater within the Former Process Area, as well as in the intertidal areas (Figure 7).

Data from the Remedial Investigation (June 1997) and subsequent investigations by the U.S. Army Corps of Engineers indicate that there are approximately 1 million gallons of NAPL in the upper aquifer of the Former Process Area. The low-permeability layer (aquitard) helps to minimize the downward vertical migration of DNAPL to the lower aquifer.

The NAPL present at the Wyckoff OUs consists mostly of a mixture of creosote, pentachlorophenol, and/or aromatic carrier oils. Creosote was used by itself in the early years of wood-treatment production. Later, it was mixed with aromatic carrier oils to obtain deeper penetration of preservative in the wood. Beginning in 1957, pentachlorophenol became commercially available for wood-preserving operations and was mixed with aromatic carrier oils.

The contaminants of primary concern in the upper aquifer groundwater are thirteen polycyclic aromatic hydrocarbons (PAHs), pentachlorophenol (PCP), and dioxins/furans[1], which are present in the groundwater in the form of mobile NAPL, dissolved constituents, and residual NAPL held in soil pore spaces. Volatile organics and base/neutral and acid extractables (BNAs) are also present in the groundwater, however, for purposes of cleanup, they are assumed to be co-located with the PAHs.

Samples collected from the upper aquifer beneath the Former Process Area were not included in the human health risk assessment due to the aquifer being classified as non-potable. The upper aquifer south and west of the Former Process Area and the lower aquifer groundwater are assumed to be potential sources of drinking water. In the upper aquifer groundwater south and west of the Former Process Area, the excess cancer risk from ingestion of groundwater by future residents ranges from $5x10^{-6}$ to $4x10^{-4}$, with the higher values found near the Former Process Area. In general, the primary contributors to cancer risk in groundwater are benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, and benzo(b)anthracene. Table 3 summarizes the maximum exposure concentration and associated risk values for chemicals of concern in groundwater.

In lower-aquifer groundwater, two of the four wells that were included in the risk assessment displayed an excess cancer risk of greater than 10^{-5} but lower than 10^{-4}. However, subsequent field investigations revealed that one of those two wells (CW12) was not screened in the lower aquifer. As a result, data from this well may be representative of either the upper aquifer or contaminant levels penetrating high permeability zones of the aquitard, but not the lower aquifer.

[1] Dioxins/furans were detected in the NAPL samples, but not in the dissolved-phase groundwater.

IV. REMEDIAL ACTIONS

EPA organized the Wyckoff/Eagle Harbor Superfund Site into four operable units (OUs) (Figure 1):

- Operable Unit 1: The East Harbor OU (PAH contaminated subtidal and intertidal sediments in Eagle Harbor; Record of Decision, September 1994)
- Operable Unit 2: The Wyckoff Soil OU (PAH, PCP, and dioxins/furans contaminated unsaturated soil; Record of Decision, February 2000)
- Operable Unit 3: The West Harbor OU (metals, primarily mercury, contaminated subtidal and intertidal sediments in Eagle Harbor, and upland sources; Record of Decision, September 1992, amended December 1995)
- Operable Unit 4: The Wyckoff Groundwater OU (the saturated soil and groundwater beneath the Soil OU; Record of Decision, February 2000)

Remedy Selection

West Harbor Operable Unit

The cleanup goals and objectives for the West Harbor OU are to achieve the State of Washington Sediment Quality Standards (SQS) and reduction of contaminants in fish and shellfish to levels protective of human health and the environment. While these goals represent a conceptual target condition, the measurable site-specific objective is the State of Washington Sediment Management Standards minimum cleanup level (MCUL), and achievement of the MCUL was the primary focus of remedial action in this OU. The MCUL must be achieved in the top ten centimeters of sediment throughout the West Harbor within ten years after the completion of active sediment remediation or within ten years from control of significant sources to areas predicted to naturally recover.

In order to define areas requiring specific types of remedial action, the objectives above were supplemented by three EPA objectives:

1) to address sediments containing 5 mg/kg (dry weight) or more of mercury, as a means of source control;

2) to address intertidal sediments containing 1,200 µg/kg (dry weight) or more of HPAH. Shellfish in such areas contained carcinogenic HPAH above EPA acceptable levels for protection of human health;

3) to address predicted biological impacts, minimize potential sediment resuspension, and limit biological uptake in areas where sediment concentrations of mercury exceed 2.1 mg/kg mercury dry weight. The sediment concentration of 2.1 mg/kg (dry weight) is more than three times the MCUL and is the High Apparent Effects Threshold (HAET) for mercury. (This is the sediment concentration of mercury above which Puget Sound test sediments have always failed acute toxicity tests for both amphipods and oyster larvae and have demonstrated chronic benthic effects).

Contaminated sediments containing 5 mg/kg or more of mercury were considered a "principal threat" at this operable unit. The selected remedy addressed this principal threat by requiring removal of these sediments from the marine environment.

The major components of the selected remedy for the West Harbor OU include:

- Further evaluation and control of potential upland sources of contamination to West Harbor sediments;

- Excavation, solidification/stabilization (if necessary), and upland disposal of sediments exceeding 5 mg/kg mercury (dry weight);

- Placement of a cap of clean sediment over areas of high concern for adverse biological effects and potential contaminant resuspension and bioaccumulation;

- Thin-layer placement of clean sediments to enhance sediment recovery in areas of moderate concern;

- Natural recovery and monitoring in areas predicted to achieve the long-term sediment cleanup objective without sediment remedial action;

- Continued institutional controls to protect human health from exposure to contaminated fish and shellfish; and

- Long-term environmental monitoring to evaluate the effectiveness of the remedy.

In December 1995, EPA issued an amendment incorporating the following changes to the September 1992 ROD:

- Construct a nearshore fill and confined disposal facility (CDF) in intertidal areas adjacent to the former shipyard property. Hotspot sediments were to be placed inside the CDF and capped with clean material and asphalt. This fill would create 0.9 acres of additional land so that the Washington State Department of Transportation (DOT) could reserve one acre of the property for private boatyard or other water-dependent operations. To compensate for habitat lost as a result of the nearshore CDF, DOT would:

  – Enhance the outer wall of the nearshore CDF with a layer of gravel and/or small pebble to provide favorable habitat (about 0.19 acre) for barnacles and mussels. The habitat would resemble habitat lost at the fill site.

  – Restore 0.6 acre of eelgrass immediately west of the nearshore fill. Eelgrass provides high quality habitat for juvenile fish and other marine life.

  – Construct a 2-acre estuarine salt marsh habitat at the South Bainbridge Estuarine Wetland and Stream Restoration Site (ultimately named Schel-chelb Estuary), near Lynwood Center.

  – Furnish the Suquamish Tribe with materials for a 1.5-acre Manila clam enhancement project.

  In addition, DOT would transfer 6 to 8 acres of tideland from the Washington State Department of Transportation to the Suquamish Tribe.

- Implement contaminant source control measures at the former shipyard property acquired by DOT, to prevent soil contaminants from entering Eagle Harbor through groundwater seeps or surface water runoff. These measures include: the treatment of heavily contaminated soils in two areas; capping of property soils with asphalt; diversion of surface water and groundwater; construction of a shoreline barrier to minimize seawater movement through contaminated soils; implementation of

pollution prevention practices; and access restrictions. These measures would meet State of Washington soil cleanup standards for industrial land use.

East Harbor Operable Unit

The primary remedial action objective for the East Harbor sediments is achievement of the Sediment Quality Standards (SQS) and reduction of contaminants in fish and shellfish to levels protective of human health and the environment. In the subtidal areas, active remediation is required if the top ten centimeters of sediment contain contaminant concentrations above the MCUL at the completion of upland source control. For the intertidal sediments, the surface ten centimeters must achieve the MCUL within ten years from control of significant sources to these areas.

The objective of the MCUL is supplemented by an objective of concentrations of 1,200 µg/kg (dry weight) HPAHs, developed by EPA to address human health risks from consumption of contaminated shellfish in intertidal areas. This objective requires that intertidal sediment high molecular weight PAH (HPAH) concentrations must not exceed 1,200 µg/kg (dry weight).

Over 50 acres of heavily contaminated subtidal sediments in the East Harbor were capped to address documented adverse biological effects and free-phase oily contamination. This action was conducted under CERCLA removal authorities and was completed prior to the Record of Decision, signed in September 1994. The selected remedy incorporated the existing sediment cap and addressed remaining areas of contamination in the East Harbor with a phased cleanup approach.

The first phase was to be completed concurrent with ongoing EPA efforts to control sources of contamination from the adjacent Wyckoff facility. Initial East Harbor actions included:

- enhancement of existing institutional controls to reduce public exposure to contaminated fish and shellfish and to protect the existing cap;
- monitoring and maintenance of the existing cap;
- environmental monitoring to assess the effectiveness of source control efforts; and
- other actions necessary to ensure protection of human health and the environment, such as demolition of in-water structures, identification of potential nearshore sediment hot spots, and evaluation of contaminant breakdown rates.

Once significant upland sources of contamination to nearshore and intertidal areas as well as subtidal contaminated areas of the East Harbor have been controlled, final sediment cleanup in the East Harbor would commence.

Soil and Groundwater Operable Units

In September 1994, EPA issued an interim ROD for groundwater, which included the following elements:

- Replacement of the existing treatment plant. The design of a new treatment plant began in late 1996 and was completed in July 1998, but the plant was not constructed pending a final remedy for the Groundwater OU.

- Evaluation, maintenance, and upgrade of the existing extraction system/hydraulic barrier operations. These activities have been completed.

- Evaluation of the performance of the existing extraction system and installation of a physical barrier, if needed. Because of continued releases to Eagle Harbor and Puget Sound despite ongoing pumping, a slurry wall was proposed as the most appropriate kind of barrier.

- Sealing of on-site water supply wells. These activities have been completed.

Future land use is unknown at this time. It is possible that some areas of the site may be residential, while others may include recreational uses. Because residential cleanup standards are the most protective, they were chosen as a goal for the soil at this site. Remedial action objectives for cleanup of the soil must address potential impacts to human residents who could be exposed to contaminants via ingestion, inhalation, or dermal contact.

Remedial action objectives (RAOs) for the Soil OU, as identified in the February 2000 ROD, are:

- Prevent human exposure through direct contact (ingestion, inhalation, or dermal contact) with contaminated soil.

- Prevent storm water runoff containing contaminated soil from reaching Eagle Harbor.

Remedial action objectives for cleanup of NAPL in the groundwater at Wyckoff must address impacts to marine water quality, surface water quality, and sediments in Eagle Harbor.

Humans have a negligible risk of direct contact on-site with groundwater at Wyckoff. Groundwater in the upper aquifer underlying the Former Process Area is not extracted now for potable, agricultural, or industrial purposes due to the high salinity levels (see Groundwater Classification and Basis, above). Site-specific groundwater contaminant concentration limits that are protective of the environment and human health were developed and can be found in Table 4. Calculated pore-water concentrations of COCs are presented in Table 5. These limits are to be met at the mudline (i.e., at the points where groundwater flows into surface water). The risks in the other two groundwater areas (the upper aquifer beneath the Former Log Storage/Peeler Area and the lower aquifer) are generally acceptable as most are below 10^{-5} risk. Where the risk exceeds 10^{-5}, the groundwater is in close proximity to the upper aquifer groundwater beneath the Former Process Area.

The remedial action objectives for the Groundwater OU are:

- Reduce the NAPL source and the quantity of NAPL leaving the upper aquifer beneath the Former Process Area sufficiently to protect marine water quality, surface water, and sediments (e.g., ensure the quantity of NAPL leaving the site will not adversely affect aquatic life and sediments). Site-specific groundwater contaminant concentration limits for the upper aquifer groundwater will be met at the mudline.

- Ensure contaminant concentrations in the upper aquifer groundwater leaving the Former Process Area will not adversely affect marine water quality, and aquatic life in surface water and sediment.

- Protect humans from exposure to groundwater containing contaminant concentrations above MCLs.

- Protect the groundwater outside the Former Process Area and in the lower aquifers, which are potential drinking water sources.

The remedial action objectives for groundwater also support the objectives for sediments identified in the 1994 Record of Decision for the East Harbor Operable Unit.

The following are major components of the selected remedy for the Soil and Groundwater OUs:

- Construct a sheet pile wall around the highly contaminated area of the Former Process Area to minimize potential flow of contaminants to Eagle Harbor during remediation.

- Conduct a pilot study to test the applicability and effectiveness of thermal remediation, i.e., steam injection. The pilot study was designed and will be implemented with the ability to expand to the full-scale system.

  EPA developed performance expectations in the February 2000 ROD for the pilot study that correspond to the final cleanup goals. If the pilot study reasonably achieves the following performance expectations, EPA believes that full-scale remediation is likely to be successful:

  – Remove substantially all the mobile free-product NAPL from the pilot treatment area.

  – Reasonably predict that the post-treatment dissolved concentrations that move from the site to Eagle Harbor and Puget Sound would not exceed marine water quality/criteria, surface water quality, and sediment standards at the mudline. EPA believes that thermal effects will contribute to significantly enhance rates of biodegradation and hydrous pyrolysis/oxidation (HPO) of NAPL constituents dissolved in groundwater before they can move to sensitive receptors or environments, thus potentially eliminating the need for a long-term remediation presence at this site.

  – Attain the Washington State Model Toxics Control Act (MTCA) cleanup levels in surface soil within the pilot study area. If MTCA soil cleanup levels are not likely to be attained, EPA may still implement full-scale remediation but will consider a combination of actions for the soil which may include a soil cap, institutional controls, or other measures integrated into the future site use to ensure long-term human health and environmental protection.

- If the pilot study is successful (Scenario 1) at meeting performance expectations, then:

  – Consolidate contaminated hot spots from the Former Log Storage/Peeler Area (LS/PA) and the Well CW01 Area (approximately 40,000 cubic yards) within the Former Process Area. EPA began soil

removal/consolidation activities in December 2000, prior to completion of the pilot project, because soil needed to be excavated in the Former LS/PA for construction of the habitat mitigation beach (see Remedy Implementation, Soil and Groundwater OUs). In late 2001, EPA began removal of remaining contaminated soil from the Former LS/PA and the Well CW01 Area. Soil removal activities were completed in February 2002.

  - Remediate the soil and groundwater within the Former Process Area by full-scale thermal treatment.

  - Construct a vapor cover over the treatment area (the Former Process Area) to enhance recovery of contaminated vapors, minimize emissions to the atmosphere, and reduce odors.

  - Monitor biodegradation, oxidation, and other thermally-enhanced attenuation processes in soil and groundwater during and after active thermal treatment is completed to confirm whether further reductions in contaminant concentrations are being achieved.

- If the pilot study is not successful (Scenario 2), then:

  - Implement the contingency remedy, which would consist of a surface soil cap over the Former Process Area, containment of contaminated groundwater and NAPL with a sheet pile wall and extraction system, and construction of a replacement treatment plant for ongoing treatment of contaminated groundwater.

- Common elements of Scenarios 1 and 2:

  – Monitor both the upper groundwater aquifer outside of the Former Process Area and the lower aquifer beneath the entire site to identify trends in groundwater data and ensure that contaminant levels are not increasing and for decreasing trends.

  – Establish institutional controls to:

    ✓ Ensure that the upper aquifer groundwater outside the Former Process Area and the lower aquifer remain unused until protective levels are reached.

    ✓ Ensure that the upper aquifer groundwater within the Former Process Area remains unused due to contaminants that may remain after thermal treatment or will remain as part of the contingency remedy. This portion of the upper aquifer is also not potable due to high salinity levels.

    ✓ Restrict site use to reduce the risk of direct exposure to surface soil, if necessary.

If successful, Thermal Remediation could provide permanent protection to human health and the environment. This alternative could remove substantially all mobile non-aqueous phase liquids, the principle threat. If successful, this alternative would be a cost-effective and permanent solution to contamination at the Wyckoff Soil and Groundwater Operable Units (OUs).

Remedy Implementation

<u>West Harbor Operable Unit</u>

The West Harbor OU consists of two areas: one at and adjacent to the old shipyard where remedial construction was performed in 1997 and where mercury was the principal threat, and a second area under the Ferry Terminal where heavy polycyclic aromatic hydrocarbons (HPAHs) were above Washington State Sediment Management Standards but were at concentrations that were expected to naturally degrade to below risk-based criteria within 10 years, as allowed under the Sediment Management Standards.

The West Harbor OU remedial construction was completed during the summer of 1997. The remedy consisted of upland remedial actions, sediment remedial actions, and habitat restoration. Completion of these activities, described below, provide the basis for the final remedy implementation of the West Harbor OU. The overall goal of the remedy was to bring the West Harbor into compliance with the Washington State Sediment Management Standards (WAC 173-204).

For all remedial construction activities, surveying was conducted prior to start of work to stake out areas for construction; during construction to measure, document, and verify the lateral and vertical extent of excavations, structures, earthwork drawings; and after construction was complete to verify the final grades. This effort included regular grade checks during earthwork activities and subgrade preparation, and hydrographic surveys for offshore areas before, during, and after dredging and capping activities were completed. Capping surveys were done by an independent surveyor.

Upland: The upland remedy was implemented to control source areas on the former shipyard property to prevent soil contaminants from entering Eagle Harbor. Upland remedial actions consisted of:

- Source control through soil stabilization of two upland "hot spot" areas;
- Installation of a tidal barrier system adjacent to the landfill located in the northwest corner of the upland area to minimize the potential for seeps that could impact capped sediments;
- Installation of a cutoff drainage system along the northern boundary of the site to intercept and cutoff surface and shallow subsurface water run-on;
- Installation of an asphalt concrete cap across the former Bainbridge Marine Services upland to minimize the potential for soils to run off to capped sediments.

Soil Stabilization. The intent of the soil stabilization work was to stabilize the upper three feet of soils in two areas, significantly reducing the leachability and permeability of the soils. Stabilization also minimized the potential for erosion by increasing the structural strength of the soil and serving as a low permeability cap over the soils. Stabilization consisted of solidification of the upper 3 feet of soil in the two source areas with a pozzolan-Portland cement system. The soil was excavated and screened to remove

material greater than 2 inches in diameter that could interfere with pug mill stabilization operations. Materials greater than 2 inches in diameter were disposed of off-site at Olympic View Landfill. Following excavation, verification soil samples were taken from the excavation faces to determine if additional excavation was necessary. At the first excavation, four verification samples were taken and were below action levels, so no further excavation was needed. At the second excavation, a total of 14 samples were taken. The action levels were 10,000 mg/kg copper, 10 mg/kg mercury, and 6,000 mg/kg zinc. During treatment, samples were taken of the production runs to confirm mix performance. Treated soils were placed back in the excavation, and quality assurance testing (for density and moisture content) was performed during placement of the treated soils.

Tidal Barrier. The tidal barrier lines the slope of the former landfill at the old shipyard. The objective of the tidal barrier was to protect the slope against erosion and washout and to contain landfill constituents such as copper, lead, and zinc, by controlling the tidal exchange to relatively deep landfill materials. The tidal barrier consists of a specially woven double-layer geotextile synthetic fabric with voids that was laid over a geomembrane layer on the existing slope and then pumped full of concrete grout to form a stable mat. The tidal barrier is anchored by a key trench at the base of the landfill slope. Topsoil was placed over a portion of the tidal barrier system as required by the specifications. The location of the key trench was determined by core sampling to confirm the presence of a 3-foot thickness of sediment over the landfill. The location of the anchor trench and lateral extent of the geomembrane and concrete mat were established and controlled during construction using a laser plane survey instrument.

North Cutoff Trench. The objective of the northern cutoff trench was to intercept seasonal shallow groundwater flowing south above the glacial till unit and to divert it to the ravine on the west side of the site so that it does not contact the remediated area. The cutoff trench was excavated along the north boundary of the site, at the base of the soil slope on the north side of the existing pedestrian footpath. The excavation was made at least one foot into the glacial till. The trench bottom and downgradient (south) side of the excavation were lined with a geomembrane under a geotextile. The drainage pipe was slotted high density polyethylene (HDPE), and was backfilled with clean pea gravel. The excavated grade of the trench was controlled during construction using a laser plane survey instrument. Geologists confirmed that the trench was completed in the till.

Grading and Paving. Finally, the upland areas (including the soil stabilization areas) were graded and paved with asphaltic concrete to provide an impermeable cap over the

underlying soils to prevent infiltration of surface water and precipitation. Prior to paving, the boat repair shop (adjacent to the former landfill at the northwest corner of the site) was torn down. Salvageable materials were separated from non-salvageable materials; demolition debris was disposed of at Olympic View Landfill. The area paved includes the boat repair shop concrete foundation, the soil stabilization areas, and the CDF (essentially all upland areas of the former shipyard that are not currently beneath a building). Surface water from the paved areas drains through catch basins and a storm water drainage system that discharges to Eagle Harbor. The Site is also fenced.

Underground Storage Tank Removal. In addition, prior to remedial construction, two underground storage tanks were removed from the former shipyard site (10,000 gallon diesel and 1,000 gallon gasoline). A third underground storage tank was discovered during remedial construction (10,000 gallon bunker oil). All tanks were removed in accordance with Ecology underground storage tank guidelines. Verification samples taken from the sides of the excavations showed no constituents remain above Ecology criteria.

Sediments: Sediment remedial actions were conducted to remediate the sediments so that they could come into compliance with the Washington State Sediment Management Standards Minimum Cleanup Levels within 10 years of active remediation, as allowed in the regulations. Intertidal and subtidal sediment remedial actions consisted of:

- removal, treatment, and disposal offsite of DU1 sediments (those that exceeded the Dangerous Waste [DW] criteria);
- removal and disposal in an on-site confined disposal facility (CDF) of principal threat hot spot sediments containing more than 5 mg/kg total mercury;
- backfilled dredged areas to pre-existing grade elevations;
- placement of a thick cap (1 meter) over sediments containing >2.1 mg/kg mercury;
- placement of a thin cap (15 centimeters) over sediments exceeding chemical or biological cleanup standards; and
- sediment armoring.

Removal of DU1 Sediments. The purpose of DU1 sediments removal was to remove and dispose of offsite those sediments that potentially exceeded the dangerous waste criteria (WAC 173-303-100). These sediments were removed from intertidal and subtidal areas and from within the footprint of the CDF. Sediments were excavated using land-based equipment such as a backhoe. Verification samples were taken from the sidewalls and base of the excavation to verify that remaining sediments were below dangerous waste criteria. The excavated sediments were then stabilized in the on-site pug mill using a Portland cement mixture. The stabilized mixture was allowed to cure on-site and then was sampled to

determine disposal. The stabilized mixture passed the testing and was not a dangerous waste, so it was disposed of at Olympic View Landfill.

Removal of Principal Threat Sediments. Sediments containing greater than 5 mg/kg total mercury were defined as principal threats for the West Harbor OU. Sediments were removed from hot spot areas containing more than 5 mg/kg total mercury. These sediments were removed using either land-based methods (during extreme low tides) or were dredged using a clamshell bucket.

Contaminated sediments in the nearshore area were removed during extreme low tide using conventional excavation methods (e.g., front-end loaders). The initial boundaries were determined using conventional range/survey techniques and were delineated using flagging and corner stakes. The required excavation depth was determined by the contractor by measuring down from the survey tag using a story pole and measuring tape. Contaminated sediments from nearshore areas (those excavated using land-based techniques) were stockpiled for dewatering on the asphalt-treated base work area (ATB pad, which drained to a sump that was pumped to storage tanks), prior to offloading to the CDF using a backhoe.

Prior to dredging, a survey was performed of the area to be dredged. A dredge plan and cut sequence to achieve the required dredge depth was produced by the contractor. Section lines showing the required excavation depth plus overall dredge allowance were transferred to a cut plan used by the dredge operator in determining the horizontal and vertical extent of the dredge cut. During dredging, hot spot material was removed in overlapping cuts along the dredge's swing path. Dredging depth was determined by siting bucket wires marked in 1 foot, 5 foot, and 10 foot increments. The dredge depth was corrected for tides, which were continuously monitored using a Hazen electronic tide gauge. Once the area ahead of the dredge was excavated to required excavation grade, the dredge would set ahead to begin it's next cut sequence. To move ahead, the dredge would elevate it's spuds and "crab" forward by paying in on an extended derrick with grounded bucket. Once in position to begin it's next cut sequence the dredge would drop its spuds to the harbor floor, effectively holding the dredge and material barge in position.

The dredge operator minimized sediment resuspension by reducing the rate at which a full bucket was retrieved through the water column. A silt curtain that allowed for tidal fluctuations extended from the water surface to the harbor floor and was in place around the perimeter of the dredging operation at all times. Contaminated sediments were stockpiled for dewatering on a barge, prior to offloading to the CDF a clam shell.

Surveys were conducted before, during, and after excavation to determine the area excavated and depth dredged. Surveys were conducted using conventional range/survey techniques (during extreme low tides); lead line soundings (for subtidal areas during construction); and hydrographic techniques (before and after dredging and capping). The hydrographic surveys were conducted using a single frequency depth sounder to acquire the vertical depth and a differential global positioning system to obtain the horizontal position. The depth sounder and positioning system were integrated with Hypack survey and navigational software so that the x,y,z survey data was recorded in real time on a data collector. The depth data was corrected for tide, which was continuously monitored using a Hazen electronic tide gauge.

Sediment samples were taken within the excavated and dredged locations after sediment removal and dredging was complete to verify that sediments remaining in Eagle Harbor were below MCUL. After this verification was complete, clean materials were placed to bring the contours back to the original grade.

Water quality was monitored before, during, and after dredging. Water quality measurements during construction were established in the EPA-issued Water Quality Certification to assure compliance with the Clean Water Act Section 401. Measures to protect water quality during dredging and cap placement include (1) use of a silt curtain around the area being dredged, (2) reducing the rate at which the dredge bucket was retrieved through the water column, (3) limiting the rate of material placement for capping. During dredging, eight turbidity and dissolved oxygen samples were taken daily from four locations (top and bottom of water column) around the area being dredged.

Confined Disposal Facility. Excavated sediments were placed in the CDF up to a height of 8.7 ft MLLW (design elevation 10 feet MLLW), below the water table. Contaminated sediments were placed in the CDF so that they would remain in a fully saturated, anoxic state so that methyl mercury (a bioavailable form of mercury) could not develop. The CDF was designed to contain contaminated dredged material, and contains a fill berm and liner under approximately 5 feet of clean fill soils and asphalt pavement. Sediments within the CDF are confined below the water table (below 10 feet MLLW). The CDF is designed to separate the contaminants from the environment, and provide additional working area for DOT.

In order to construct the CDF, Pier B at the south end of the site was torn down. The piles from Pier B were cut off 2 feet below the mud line within the foot print of the CDF to prevent the overlying liner from being damaged by the piles during construction. Other onshore pilings were cutoff using a chainsaw; offshore pilings were pulled out using a vibratory hammer. Debris was disposed of offsite at Olympic View Landfill.

Prior to dredging, the CDF perimeter containment berm was constructed. First, a key trench was constructed along the offshore edge of the berm footprint. The intent of the trench was to removed soft subgrade soils that, if left in place, may have adversely affected the overall long-term seismic stability of the berm. The materials excavated from the key trench were placed in the inner half of the containment berm. Approximately 25 ecology blocks (large concrete blocks) were placed near the middle of the berm footprint to retain dredged key material and remain permanently within the berm. The berm was created using training dikes along the inner and outer edges of the berm which were filled with select fill material. The select fill material was compacted with a vibratory roller following placement of each lift. The top of geomembrane was keyed into a trench on the inner side of the CDF berm and secured in place by additional ecology blocks. After completion of the berm, a gravel habitat enhancement cap was placed on the outer slope up to 12 feet elevation to provide habitat and quarry spalls were placed above this (riprap).

An HDPE liner was placed across the bottom and inside slopes of the CDF to maintain static groundwater elevation within the CDF at 10 feet MLLW. Adjacent membrane edges were overlapped 3 feet. A geotextile was placed under the liner on the slopes to protect the liner from the rocks of the training dike.

The elevation, slopes, grade, and lateral extent of the CDF berm were regularly checked during construction using a laser plane survey instrument. No water was discharged from the inside of the CDF during placement of dredged sediment, so water quality monitoring was not needed during this procedure. Compaction of select fill in the berm and buffer material over placed sediment was tested in the field during construction using a nuclear dosimeter.

Sediment Capping. Sediments were capped based on the concentration remaining in the in-place sediments. The intent of the sediment capping activities was:

- to isolate residual mercury-contaminated, marine sediments from the surrounding water body and
- to effectively lower the sediment concentrations in the biologically active zone (top 10 cm, approximately 6 inches).

All cap material was obtained from the Lone Star quarry in Steilacoom, WA; Jack Cewe Limited; and Fred Hills Facility in Poulsbo, WA.

Once removal of principal threat hot spot sediments had been verified by post-verification sediment sampling, areas of "moderate concern" (between 2.1 mg/kg and 5 mg/kg mercury) and "low concern" (between 0.59 and 2.1 mg/kg mercury) were covered with thick and thin caps of clean sediment, respectively. The thick cap consisted of a minimum of 30 inches of capping material with 6 inches overplacement allowance, plus a minimum of 6 inches of gravel cap with a 6 inch overplacement allowance. The thin cap consisted of a minimum of 6 inches of capping material with 6 inches overplacement allowance, plus a minimum of 6 inches of gravel cap with a 6 inch overplacement allowance. Although the initial requirements included an additional 6 inches of gravel armor on top of certain portions of the cap to prevent erosion caused by Washington State Ferries vessels, the contractor was able to obtain 4-inch-minus capping material that allowed the cap to perform as the armor. The final design depth of the caps was 36 inches for the thick cap and 6 inches for the thin cap (the biologically active zone).

The caps were placed (1) mechanically by dropping the sediments using a clamshell dredge bucket, (2) hydraulically by washing the clean sediment off of barges using a high pressure water jet, and (3) (in portions of the thick cap adjacent to the shore) by land-based methods such as using backhoes. Monitoring methods used to assure that the cap was placed as designed were the same as those used to determine that the area dredged was as designed.

Capping using the clamshell method was performed by grabbing material from the material barge and swinging the full clamshell to the cap area ahead of the dredge. The clamshell was swung as deep as possible in the water column while still providing some level of visibility for placement control. Generally, the clamshell bucket was swung just below the waterline and opened a small amount to allow the material to fall out over a controlled swing path. The cap material fell through the water column and settled over the cap area. To account for factors such as loss of fines in suspension and positioning inaccuracies, the contractor

typically placed an additional 12 inches of capping material over thick cap areas and 6 inches of capping material over thin cap areas. During construction lead-line soundings were made to determine cap thickness. In addition, post-cap surveys were performed using hydrographic and topographic electronic surveying methods to identify capped areas not meeting required thickness. Additional material was added to these areas, and additional post-cap soundings were performed over the "low spots" to verify that all capped areas had the required cap thickness.

Hydraulic placement was used to place the cap material located under Pier A and the DOT dock. The hydraulic placement technology used a centrifugal pump mounted on a deck barge to transport a capping material slurry to the areas under the docks. The water for the slurry was obtained from the harbor through a pump intake on the side of the barge. The capping material was placed in a hopper above the pump and introduced to create the slurry on the discharge side of the pump. The slurry was pumped through a 100' HDPE pipe. The discharge end of the pipe was capped and a 6' wide by 36" long slit was cut in the upper portion of the pipe near the end. The slurry discharge was controlled manually by two lines attached to the end of the pipe. The slurry was placed approximately 3 to 6 feet below the water surface over the intended capping area. The slurry discharged upward initially about one to two feet then gradually fell through the water column and settled on the harbor floor. EPA requested that water quality monitoring be performed to address observations of turbidity created by the hydraulic cap placement techniques. Water quality monitoring was implemented for the remaining hydraulic capping effort; no non-compliance discharge events were found during the remainder of the hydraulic capping period. Water quality samples for turbidity and dissolved oxygen were taken from the edge of the compliance zone boundary and within the mixing zone from three depths: surface, middle, and bottom.

Hydraulic method capping thickness was monitored by both placement of a known volume of material over a known area between pilings with allowances for an additional foot over thick cap areas to account for losses and placement inaccuracies. In addition, pre- and post-cap lead line soundings were made. Additional material was added until the minimum required thickness was achieved.

Land-based placement was used in the intertidal areas accessible from land during extreme low tides. Capping was performed using Bobcats and small backhoes. About half of the land-based capping work was performed adjacent to the docks. To minimize sloughing and facilitate a safe work environment, excavations were immediately capped. In general, the excavation/capping sequence proceeded from west to east, allowing the Bobcats to transport clean material over the stable capped surface. Care was taken to minimize mixing of the

capping material with the excavated hot spot material. Where spillage of the contaminated material occurred over a capped area, the affected capping material was removed and replaced with clean material. In addition, approximately 32 CY of coarse round "fish rock" at and below the –3 feet MLLW contour was placed underneath the dock area to mitigate the effects of scour due to DOT vessel prop wash.

Pre-cap, post-cap, and quality control surveys were performed using hydrographic and topographic methods for offshore and under dock capping, respectively to verify that adequate cap thicknesses had been placed.

Habitat Restoration: In order to compensate for the loss of 0.9 acres of aquatic habitat when the CDF was built, the PRPs performed various habitat restoration activities. These activities included:

- enhancement of the face of the CDF berm face with gravel/cobble layers (approximately 0.2 acres);
- an attempt to establish a 0.6-acre eelgrass planting site immediately west of West Harbor OU CDF and cap;
- construction of a 2-acre Schel-chelb Estuary at the south shore of Bainbridge Island;
- providing the Suquamish Tribe with $110,000 for clam enhancements and other restoration projects performed by the Tribe.

Habitat mitigation completed as part of the 1997 West Harbor Operable Unit (WHOU) remedial work included construction of on-site gravel/cobble habitat layers on the seaward face of the CDF during construction. In addition, the contractor also enhanced an additional 0.2 acres of habitat by placing gravel/cobble layers on the surface of the tidal flow barrier during construction of the tidal barrier (see above).

A 0.6-acre eelgrass transplant site was established immediately west of the CDF and cap in September-October 1998, after water quality surveys and laboratory experiments in 1997 indicated that this location would support eelgrass growth. Approximately 10,000 eelgrass shoots were planted in 1998. Monitoring of the eelgrass was to be conducted over 4 years to determine survival and spread (see below). The eelgrass did not survive, and additional habitat mitigation is required.

The Schel-chelb estuarine mitigation site is located at the southwestern end of Bainbridge Island, 2.1 miles southwest of the Superfund Site. It is the site of a previously existing estuary that was filled in during road construction around 1900. The mitigation site is designed and constructed to be a naturally functioning wetland. The site provides one acre of upland buffer and two acres of

tidal inundated estuarine wetland. The wetland is divided into mudflat, low salt marsh, and high salt marsh habitats. A freshwater component is provided by the restored stream which empties into the north end of the mitigation site. The south end of the site is connected to Puget Sound via a 40-foot long, 24-inch diameter culvert. Construction of the estuary was completed in early summer of 1997, and was planted from February through late spring 1998.

East Harbor Operable Unit

The East Harbor Subtidal Cap was completed in three phases over seven years, and when appropriate and necessary, was coordinated with activities on the Soil and Groundwater OUs. Completion of the subtidal cap and intertidal activities described below provide the basis for the final remedy implementation of the East Harbor OU.

Phase I: EPA issued an Action Memorandum for a non-time-critical removal action on June 15, 1993. EPA limited the removal action to those heavily PAH-contaminated marine sediments in the East Harbor OU where sediment toxicity had been documented by the remedial investigation and where NAPL have been observed on the Harbor sediment surface. Clean sediments were beneficially used from a federal dredging project in the Snohomish River near Everett, Washington. This material underwent chemical and biological testing under the Puget Sound Dredged Disposal Analysis (PSDDA) program, and was found suitable for open-water placement. The U.S. Army Corps of Engineers (USACE), through an interagency agreement (IAG) with EPA, coordinated the design, implementation, and oversight of cap construction and monitoring. Sediment placement activities began September 1993, and concluded in March 1994.

The objective of the removal action was to bring surface sediments located in the East Harbor OU into compliance with the Washington State Sediment Management Standards Minimum Cleanup Levels (WAC 173-204-520). Placement of clean dredged sands over the contaminated sediments met that objective and also accomplished the following:

- Isolate the contaminated sediments, blocking vertical migration of contaminants.
- Effectively lower the sediment contaminant levels in the biologically active zone, defined by the results of the RI/FS as the upper 10 centimeters (cm).
- Provide a clean substrate for recolonization by benthic infaunal organisms.

The goal of placement was to cover the contaminated sediments with a uniform 3 foot layer of clean sediments. Approximately 275,000 cubic yards (cy) of dredged material was placed in the East Harbor, covering over 54 acres, to complete the removal action. Two placement methods were used: (1) washing from the deck of a barge with a high-pressure water jet. This method of placement minimized the amount of re-suspension of contaminated sediments or "splashing" of NAPL up into the water column by reducing the impact velocity of falling cap material; and (2) split-hull barge with restricted opening angle on the barge.

Phase II: In 2000-2001, EPA extended the original sediment cap by an additional 15 acres in a nearshore area adjacent to the former Wyckoff facility, known as the log-rafting area. This area was not remediated during Phase I due to a lack of upland source control at the time. Efforts were made to obtain appropriately-sized capping materials from nearby navigational dredging projects. However, due to scheduling conflicts and cost, approximately 120,000 cubic yards of borrow material was purchased from Glacier Northwest quarry located in Dupont, Washington. The cap extended from the 1994 cap's approximate 3-foot thickness contour (located approximately 900 ft offshore) to the Wyckoff facility's northern shoreline (Figure 8). The cap material was washed from flat-deck barges with a high-pressure water jet as the barge

continuously moved (by tug) to avoid excessive placement at one location. Similar to the first phase of the cap, this method assured that the sediments fell gradually to minimize resuspension of contaminants into the water column, while allowing placement of a relatively uniform layer of material over a large area.

Phase III: In early 2002, EPA placed an additional 50,000 cubic yards of clean borrow material in a shallow subtidal area to create intertidal habitat to form a continuous intertidal beach along the Eagle Harbor shoreline (Figure 8). This area is known as the Intertidal Cap and connects the new habitat beach to the west (created to mitigate for the construction of the sheet pile wall (see below)), with existing intertidal areas to the east. This area is sloped from the shoreline at +13 feet mean lower low water (MLLW) to approximately -15 feet MLLW. This cap also finalized coverage of contaminated sediments in the former log-rafting area. Dredged material was not suitable for this phase of the cap due to placement by conveyor from a barge. Borrow material from the Glacier Northwest quarry located in Dupont, Washington was utilized. The majority of the cap was constructed with material similar in size to that used for the Phase II cap and the mitigation beach. A surface layer of "fish mix" was added to assure continuity with the mitigation beach. On the east side of the Phase III cap area, larger material including cobbles was added to maintain consistency with the naturally occurring materials in that area.

For each phase of capping, the following monitoring methods were used to assure that the cap was placed as designed and that water quality standards were met. The designed cap thickness and known area of coverage provided an estimate of the total volume of material required. The position of the barges were determined using a differential global position satellite system displayed to the tug operator in "real time" on a laptop computer located in the tug wheelhouse. The barge locations were updated every 30 seconds. As new locations were added, the tug operator maneuvered to create uniform coverage. Every minute, barge positions were recorded on-board the tug and, via radio link, at the U.S. Army Corps of Engineers Seattle office, where the positions were plotted and connected to create barge track lines. The density of track lines and the known quantity of material placed over the time during which the track line were plotted were used to estimate areas that needed additional material or areas to be avoided because they had already received material. The success of this placement method was critically dependent on the ability to monitor and record barge positions.

The extent and thickness of the accumulated cap material were monitored using bathymetric surveys. Bathymetric surveys were carried out to assure that capping material accumulated in a manner that led to the desired coverage and cap configuration. Consecutive surveys of pre- and post-construction bathymetric measurements were also used to confirm that the desired thickness of capping material was placed over the entire area of concern.

All water quality measurements during construction were established in the EPA issued Water Quality Certification to assure compliance with the Clean Water Act Section 401. Measures to protect water quality during cap placement included: (1) placement of sorbent booms, (2) temporarily stopping work if measurements indicated that water quality (turbidity or dissolved oxygen) was being jeopardized, and (3) limiting the rate of material placement. Turbidity and dissolved oxygen measurements at three locations were used to the extent practicable to accomplish real-time monitoring, after an initial sampling of the water to gather baseline data.

Soil and Groundwater Operable Units

Groundwater Treatment Plant and Extraction System: As summarized above, interim remedies selected in the September 1994 Groundwater OU Interim ROD are either completed or are on-hold. The existing groundwater treatment plant and reconstructed extraction system continues to be operational. The extraction system of seven active wells provides an average pumping rate of 35 gallons per minute (gpm) 24 hours per day, seven days per week. Ongoing extraction and treatment of contaminated groundwater is necessary to maintain an inward gradient within the contaminated upper aquifer and an upward gradient from the lower aquifer to the upper aquifer. The primary purpose of the extraction system and treatment plant is to maintain hydraulic control of the upper aquifer by pumping and treating of contaminated groundwater. The secondary purpose is to recover creosote product (NAPL) from the subsurface. The extraction system and treatment plant continues to remove approximately 200-300 gallons of L- and DNAPL per month, and treats approximately 2 million gallons of contaminated groundwater per month, respectively. To date, the extraction system has recovered approximately 100,000 gallons of NAPL and the treatment plant has treated over 370 million gallons of extracted contaminated groundwater.

While the treatment plant and extraction system are currently operational, both systems continue to require extensive preventative and corrective maintenance. In many cases, pumps in the extraction system and treatment plant have reached the end of their service lives and require rebuilding. Corrosion and chemical incompatibility between the original materials of construction and site contaminants and conditions contribute to ongoing maintenance issues. In preparation for the steam injection pilot study, an aggressive pump rebuild schedule was implemented. Other components of the treatment system require extensive maintenance or replacement in the near future for the existing system to remain operational. These maintenance activities include:

- Repair or replacement of the existing depurator (primary treatment) in the treatment plant. The depurator has largely ceased to function since January 2002 and has been replaced in preparation for the steam injection pilot study.
- Replacement of the biofilter tank (T-205), which is badly corroded and is showing indications of structural failure.
- Replacement of polyvinyl chloride (PVC) piping within the treatment plant that has degraded due to contact with hydrocarbon-contaminated groundwater.

- Replacement of filter media in the multimedia filters which are becoming clogged with solids from the activated sludge component of the treatment system.

- Removal of sludge and repair to two large equilization tanks (T-401 and T-402), which have not been serviced for the last 12 years and were damaged in the February 2001 earthquake.

Despite these maintenance challenges, the treatment system continues to operate at a high rate of efficiency. This is particularly true of the activated sludge component of the system. The activated sludge system represents the treatment plant's secondary treatment that utilizes microbiological activity to treat contaminated groundwater. Since January 2002, the biological treatment system has consistently reduced PAH concentrations by 99% and PCP concentrations by greater than 98%. This high removal efficiency has drastically reduced the amount of activated carbon consumed in the treatment plant's tertiary system (granular activated carbon). Effluent discharge limits to Puget Sound have never been exceeded.

Sheet Pile Containment Wall: In addition to the extraction/treatment system, a physical barrier has been constructed to reduce the migration of contaminants from the Wyckoff facility to Eagle Harbor and Puget Sound. Two sheet pile walls were constructed on the Wyckoff site from November 2000 to February 2001: a 1,870-foot-long outer wall along the shoreline surrounding the Former Process Area, and a 536-foot-long inner wall surrounding the steam injection pilot test area to prevent recontamination during and after the pilot project (Figure 5). Driving depths varied from 25 to 90 feet for the outer wall and 15 to 45 feet for the inner wall. The toe of the walls were keyed a minimum of 4 to 5 feet into the upper surface of the underlying glacial till (or aquitard). The aquitard is a highly impermeable barrier between the upper and lower aquifers that minimizes the migration of creosote product into the lower aquifer. The outer wall was constructed 10 to 35 feet seaward from the shoreline near the toe of the riprap along the eastern and northeastern shoreline and just beyond the bulkheads along the western side of the site (Figure 9). This alignment was developed to avoid debris and buried obstacles the sheet piles may encounter during construction. The resulting total intertidal and subtidal habitat loss was approximately 0.69 acre. The space between the piles and the shoreline was backfilled with clean silty sand excavated from the Former Log Storage/Peeler Area. (See Habitat Mitigation Beach Construction, below).

In the event that the steam injection pilot project does not meet performance goals, the outer sheet pile wall will remain in-place and form the principal component of the containment remedy.

EPA selected the British Steel Frodingham interlock for its tight joint to minimize leakage of contaminants into the surrounding surface water. The British Steel Z-section No. 5 piles, meeting American Society for Testing and Materials (ASTM) A572, Grade 50 steel, was selected for its strength and driveability in the existing soil conditions at Wyckoff. Joint sealants were not used in the interlock joints for a number of reasons: (1) up to 95 foot driving depths, (2) driving through 20 to 30 feet of dense cobbles, (3) a 10 foot tidal fluctuation, and (4) the potential site-wide use of steam injection. Polymer, elastomeric and bituminous seals are not capable of maintaining an intact seal when subjected to thermal conditions and cementitious products will not maintain integrity when exposed to thermal gradients. However, to further reduce leakage through the sheet pile joints, every other sheet pile pair were welded at the joints prior to installation, thereby reducing the rates of potential leakage by half.

Approximately 200,000 square feet of sheet pile was required for the outer containment wall and pilot area wall. This quantity required two mill rollings and approximately four months from time of placing the order to delivery on-site. Construction began in early November 2000. The construction schedule was established, in part, due to significant concerns voiced by the nearby community of noise impacts. The community requested a winter construction season when they are more likely to be indoors with windows and doors closed. However, construction had to be completed by February 15, 2001 when no in-water work is allowed due to Endangered Species Act (ESA) requirements. EPA completed construction of the sheet pile wall on February 14, 2001.

The sheet pile walls were constructed as cantilever walls, meaning that support for the walls is provided solely by the interaction between the driven piles and the surrounding soil. Over the majority of the wall alignment, geotechnical investigations indicated the site soils were competent enough to maintain the walls' vertical position without large anchoring systems. The installation of anchoring systems would have required extensive excavation in highly contaminated soils and NAPL-containing strata. Installation costs would have increased along with potential exposure of construction workers to site contaminants.

On the western segment of the outer wall alignment, sediments were not competent to provide structural support for a cantilever wall. As a result, an engineered embankment comprised of quarry spalls was designed and constructed outside the wall to provide additional support. During construction, the sheet pile wall was driven to the embedment depth. Once the sheet pile was in place, the embankment stone was placed outside the wall at the same time random backfill was placed against the wall on the inside. The goal was to load both sides of the wall simultaneously to maintain the placed sheet pile's vertical position.

The sheet piles were driven using both impact and vibratory hammers. A 500 horse power vibratory hammer was used to start the sheets and drive them to the interface with the underlying glacial till layer (aquitard layer). The vibratory hammer was selected to reduce noise impacts to the surrounding community and turned out to be the more productive installation method. A 40,000 foot-pound hydraulic impact hammer was used to drive sheet piles to the designed embedment depth in the aquitard layer. In addition, the vibratory hammer was replaced with the impact hammer when soil conditions reduced driving progress to less than 1 foot per minute. This was done to avoid fusing of the interlock joints, which tended to occur when driving progress slowed using the vibratory hammer.

Some major concerns during construction of the sheet pile were the possible mobilization of NAPL from the Wyckoff property to Eagle Harbor, possible impacts to two listed threatened species under the ESA, possible impacts to water quality, and possible noise impacts to the surrounding community and the environment. On-site controls that were implemented to avoid or minimize potential impacts included limitations on the construction hours, control of installation methods (i.e., the vibratory hammer provided a quieter method of installation than the impact hammer), water quality monitoring, and the installation of temporary geotextile fences in the water in the former log-rafting area (a subtidal area of significant NAPL contamination on the harbor floor directly adjacent to the site). Floating containment booms were also available on-site for deployment offshore along with sorbent material. Booms and spill cleanup material were deployed on several occasions in response to releases during construction.

Habitat Mitigation Beach Construction: To offset this habitat loss associated with the sheet pile wall construction and to enhance existing shoreline functions of Eagle Harbor and the adjacent Puget Sound shoreline, EPA created a total of 1,154 feet (approximately 2 acres) of intertidal beach along the western portions of the property (in the north portion of the Former Log Storage/Peeler Area).

Approximately 40,000 cubic yards (20,000 of which was contaminated) of upland soil was excavated and approximately 1,000 linear feet of deteriorated bulkhead was removed to create the habitat beach. The uncontaminated soil was used as backfill behind the sheet pile wall (between the wall and the shoreline) and the contaminated material was consolidated within the Former Process Area inside the confines of the sheet pile wall. Once the soil was removed, the new sloped surface was covered with imported sediments with a grain size preferred by endangered species and smelt. The finished beach provided additional habitat at a 1:10 slope up to an approximate elevation of +11 to +15 mean lower low water (MLLW). The riparian zone or upland edge of the newly created intertidal beach was planted with over 2,000 native plants,

shrubs, trees, and grasses to provide a buffer and natural transition from the beach to the shoreline.

The project increased the area of available forage fish-spawning habitat; provided feeding, resting, and habitat for migrating salmonids; and provided a connecting corridor between existing habitats within Eagle Harbor and Puget Sound.

Contaminated Soil Removal: As mentioned above, 20,000 cubic yards of contaminated soil was removed from the Former Log Storage/Peeler Area (LS/PA) during creation of the habitat beach. The newly exposed soil surface within the habitat beach construction area met the standards of the Washington State Model Toxics Control Act (MTCA) Method B cleanup levels for PAHs, PCP, and dioxins/furans (Table 6). An additional 9,620 cubic yards of contaminated soil was removed subsequent to the construction of the habitat beach. This material was located south of the beach construction area in the Former LS/PA and in the Well CW01 Area on the hillside south of the Former Process Area. A combination of confirmation samples collected during the contaminated soil removal and characterization data collected during the effort to refine soil removal areas is being used to demonstrate compliance with the MTCA Method B cleanup levels across the site outside the Former Process Area.

The February 2000 ROD for the Soil and Groundwater OUs originally indicated that the removal of contaminated soil from the Former Log Storage/Peeler Area and the Well CW01 Area would be completed after the steam injection pilot study performance assessment was completed. Improved soil delineation data reduced the estimated quantity of contaminated soil requiring remediation. Due to the presence of heavy earth-moving equipment on-site for the construction of the thermal pilot infrastructure, an opportunity developed to complete the removal of the reduced quantity of remaining contaminated soil in the Former LS/PA and the Well CW01 Area ahead of schedule. This early removal was consistent with the remedial objectives for the Soil OU in preventing human exposure with contaminated soil by dramatically decreasing the area of soil contamination and consolidated all contaminated media in the Former Process Area. Excavated areas in the Former LS/PA were backfilled with a combination of clean borrow material imported to the site mixed with clean native soil stockpiles that remained after the construction of the habitat mitigation beach. The excavated area in the vicinity of Well CW01 was graded to approximately the natural slope of the hillside.

Steam Injection Pilot Study: Steam injection was first developed by the petroleum industry in the 1930s to enhance the recovery of oils from reservoirs. In petroleum industry applications, steam is injected to lower the viscosity of heavy oils and to increase volatility of light oils. In the late 1980s, this technology was used for soil and aquifer remediation, and has been found to be very

effective with persistent compounds such as creosote. A heat source is delivered via injection wells enhancing recovery of contaminants by: (1) reducing the viscosity of contaminants, (2) increasing the contaminant vapor pressures, (3) increasing contaminant solubilities, and (4) increasing microbial degradation and enhancing hydrous pyrolysis oxidation (contaminants mix with oxygen, and in the presence of heat, oxidize into carbon dioxide and water). Extraction wells are placed within and surrounding the contaminated zone to collect the contaminants in the forms of water, vapor, and oily product.

The February 2000 ROD selected thermal remediation, specifically steam injection, as the cleanup alternative for the soil and groundwater operable units. The cleanup is to be conducted in two phases, with the pilot study being the first phase. If the pilot study reasonably achieves the performance goals, then EPA will make the decision to expand the project to full-scale (i.e., site-wide) steam injection remediation. However, if the pilot study does not reasonably achieve the performance expectations (see Remedy Selection, Soil and Groundwater OUs, above), EPA may conclude that full-scale remediation is not likely to achieve the cleanup goals for the site. If this determination is made, the contingency remedy of containment with a soil cap, sheet pile wall (already in-place), and replacement treatment plant will be implemented.

A 536-foot-long sheet pile wall was constructed to form a 1-acre area for the Steam Injection Pilot Project (Figure 5). The total surface area of the pilot study is approximately 38,000 square feet. The total treatment volume is approximately 35,300 cubic yards and an estimated 60,000 gallons of NAPL is within the confines of the pilot area sheet pile wall. The purpose of this sheet pile wall is to prevent recontamination of the treated area and to gain project information such as leakage rates and heat transfer through the wall.

In addition to the sheet pile wall, the pilot study system components are fully constructed and steam injection equipment start-up and testing began on September, 16 2002. Steam injection operations will begin by the end of September. The steaming phase is scheduled to last for a period of 6 to 8 months with an additional 6 months of continued contaminant extraction, for an operation period of approximately one year. EPA will evaluate the data at the conclusion of the pilot project and will make the decision regarding final Former Process Area soil and upper aquifer groundwater cleanup sometime during the beginning of fiscal year 2004. The pilot study project includes the following major components, as discussed in further detail below: vapor cap, heat plant (boiler, feed water, fuel source), injection and extraction wells, heat exchangers/condensers, water treatment system, and monitoring and process control.

Vapor Cap. The purposes of the vapor cap are to prevent potential escape of vapors, to aid in the removal of contaminants from the unsaturated soil, and to improve steam flow through near-surface contaminated soil. The vapor cap (from the bottom up) consists of an 8-inch thick gravel layer containing 4-inch diameter horizontal steel pipes for collection of vapors at the surface of the

vadose (unsaturated) soil, a 6-inch protective soil layer, a high-density polyethylene (HDPE) geomembrane layer, a 12-inch protective soil layer, and finally, a 6-inch gravel layer to allow for movement of drill rigs over the surface of the vapor cover (Figure 10).

Heat Plant. The heat plant consists of a 27,600 pound mass/hour (lbm/hr) 800 horse power fire tube boiler. The boiler is housed in a pre-fabricated "boiler building" along with heat exchangers, boiler blow down tanks, water softening equipment, a deaerator, liquid ring vacuum pumps, a compressor, and several conveyance pumps. Approximately 50 gallons per minute (gpm) of water is withdrawn from the on-site water well to produce steam for injection. Low sulfur (<0.5%) diesel fuel oil is used as boiler fuel source. During periods of maximum steam injection, the boiler will consume approximately 5,400 gallons of fuel per day with an estimated total fuel usage of 260,000 gallons to heat up the pilot area and deliver 2 pore volume (PV) equivalent of condensate to the subsurface.

Injection and Extraction Wells. There are 16 injection wells and seven extraction wells within the pilot area (Figure 11) comprising a total of seven treatment zones/polygons. The injected steam temperature is approximately 120°C with the goal of heating the pilot area to a soil temperature of 110°C. Pressure cycling will begin when steam has penetrated all extraction wells and most of the treatment zone is heated to maximum temperatures. The primary objective of pressure cycling is to optimize contaminant recovery by maintaining an economical mixture of groundwater and steam in the aquifer.

Heat Exchangers/Condensers. Liquid-liquid heat exchangers and condensers will be used to heat the boiler feed water to 80°C for conversion to steam. Hot extracted liquids (and hot condensate) are pumped to two liquid-liquid heat exchangers and cooled from approximately 90°C to 40°C. Hot extracted vapors are condensed and cooled from approximately 90°C to 40°C using a condenser.

The vapors that do not condense (non-condensable vapors) are conveyed to the vapor treatment system within the boiler, with a thermal oxidizer providing vapor treatment when the boiler is not in operation.

Water Treatment System. The existing wastewater treatment plant was modified to accommodate treatment of liquid waste streams from the pilot study operation, in addition to continuing treatment of contaminated groundwater extracted from the rest of the Former Process Area. Modifications included installation of a dissolved air flotation (DAF) unit, removal of unused equipment, and replacement of all PVC piping with HDPE. Treated effluent will meet the substantive requirements of the State of Washington National Pollution Discharge Elimination System (NPDES) permit (Appendix A) prior to discharge via an outfall to Puget Sound. Based on mixing model analysis, the effluent would comply with the water quality for temperature.

Monitoring and Process Control. EPA will monitor the following during the pilot study:

- Thermal monitoring using thermocouples (467 monitoring points) and distributed temperature sensors (DTS) (169 monitoring points) to evaluate heating effectiveness, determine location and direction of steam fronts, and steam patterns.
- Community and environmental impacts monitoring which include boiler emissions, noise, air quality, nearshore marine habitat thermal effects, and the lower aquifer.
- Compliance monitoring of the treatment plant effluent discharge and boiler emissions to ensure compliance with regulatory protocols.
- Process monitoring for diagnostics and process control of the various steam injection operation systems.
- Microbial degradation studies to assess the survivability of microorganisms following steam treatment and the ability of microorganisms to continue to exhibit degradation of residual contamination.

System Operations/O&M

For detailed discussion relating to System Operations and O&M, see Section VI, Five-Year Review Process (Data Review; Site Inspection), and Section VII, Technical Assessment.

Annual System Operations/O&M Costs

	1998	1999	2000	2001	2002
West Harbor OU	$185,000	$185,000	$185,000	$185,000	$185,000
East Harbor OU	$0	$250,000	$0	$0	$150,000
Soil OU	N/A	N/A	N/A	N/A	N/A
Groundwater OU	$860,000	$885,000	$900,000	$1,091,000	$1,124,000

V. PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

This is the first five-year review for the site.

VI. FIVE-YEAR REVIEW PROCESS

Administrative Components of the Five-Year Review Process

Development of the project five-year review process, identification of the review team, and development of the review schedule was completed in the beginning of 2002. The Wyckoff/Eagle Harbor Superfund site Five-Year Review team was led by Hanh Gold, of EPA, Remedial Project Manager (RPM) for the Soil and Groundwater OUs, and included Ken Marcy, RPM for the East and West Harbor OUs, Andrea Lindsay, EPA community involvement coordinator (CIC), and team members from the U.S. Army Corps of Engineers with expertise in biology, hydrogeology, and risk assessment. Chung Yee of the Washington State Department of Ecology assisted in the review as the representative for the support agency.

The review team established the review schedule whose components include:

- Community Involvement
- Document Review
- Data Review
- Site Inspection
- Interviews
- Five-Year Review Report Development and Review

Community Notification and Involvement

The Wyckoff/Eagle Harbor Site is a high profile site, with an active public involvement program. Local residents were expected to be interested in the five-year review process, and to appreciate the opportunity to influence the effort and learn about the findings. This is a site that warranted

a more intensive communication program for the five-year review process than the minimum outlined in EPA's Comprehensive Five-Year Review Guidance, June 2001.

As such, the plan for involving the community in review activities took a multi-pronged approach. It included a meeting with the Association of Bainbridge Communities (ABC), two fact sheets, newspaper ads, direct interviews with selected island residents and local officials, and a public meeting. These activities are summarized below.

In response to requests from the community, EPA made the draft Five-Year Review Report available for informal public review for 18 days. EPA did not receive any comments from the community, however, the City of Bainbridge Island provided several comments, which have been incorporated into the final Five-Year Review report.
A summary of the final report will be mailed in a fact sheet to the community. An ad will also announce its availability. The final report will be placed in the local information repository and on the site's web page at http://yosemite.epa.gov/r10/cleanup.nsf/sites/wyckoff.

Fact Sheets. In February 2002, EPA issued a fact sheet which provided an update about site activities and recent accomplishments, and introduced the Five-Year Review. The fact sheet, mailed to about 700 island residents, invited readers to contact EPA to provide information or discuss the review. In August 2002, EPA issued a comprehensive fact sheet containing responses to frequently asked questions by the community about the Wyckoff/Eagle Harbor Superfund Site. Copies of the fact sheets are included in Appendix B. The fact sheets were also made available on the site's web page.

Meeting with Association of Bainbridge Communities. On March 19, 2002, EPA met with ABC to discuss the five-year review process. EPA provided a brief overview, with specific emphasis on the community involvement piece of the process. The group previewed and commented on the potential questions for interviews, discussed alternative methods of information collection, and generally discussed the process.

Newspaper Ad. EPA ran newspaper display ads in two local papers during mid-March 2002. The ads introduced the Five-Year Review, invited suggestions, and solicited information related to the review. The text of the ads is included in Appendix C.

Interviews. In April 2002, EPA conducted informal interviews with one adjacent resident, one resident across the bay, and one community activist. Additionally, interviews were conducted with a representative from the Bremerton-Kitsap County Health District, the City of Bainbridge Island, and the Suquamish Tribe. The NOAA Restoration Center, the Washington State

Department of Natural Resources (DNR), and the Washington State Department of Fish and Wildlife (WDFW) (the Natural Resource Agencies) also provided input to the five-year review. Interviews with residents took place by telephone. Interviews were free-flowing, covered only questions relevant to the particular interviewee, and were open-ended in terms of topics. A document which outlines the background information provided and the range of questions asked during the interviews is included in Appendix D. Notes from interviews with the City of Bainbridge Island, the Suquamish Tribe, and input from the Natural Resource Agencies are included in Appendix E. Notes from community interviews are also enclosed in Appendix E. (It should be noted that EPA conducted nearly a dozen personal interviews with community members in June and July of 2000 to learn about local concerns and perceptions about the site. The results of those interviews are summarized in the Community Involvement Plan Update, dated November 2000. Those interviews have some relevance in terms of characterizing community impacts and have been considered as part of this five-year review process.)

Public Meeting. On June 13, 2002, EPA hosted a public meeting to give an update about site activities and to engage community members in a discussion about the Five-Year Review. About 20 people attended the meeting. The meeting was announced via mailer and in local newspaper ads. A broad range of issues was raised by residents. Topics included potential nuisance issues, questions about site activities and project schedules, and environmental considerations. An informal record of items discussed at the meeting is summarized in Appendix F.

Document Review

This five-year review consisted of a review of relevant documents including treatment plant and extraction system performance and compliance data, O&M records and monitoring data from removal and remedial actions. Remedial action objectives (RAOs), applicable relevant and appropriate requirements (ARARs), and cleanup standards, as listed in Record of Decisions from all four operable units, were also reviewed. Appendix G includes a list of documents that were reviewed as part of the Five-Year Review.

Data Review

West Harbor Sediment Remediation Monitoring

Data have been gathered for four years since the implementation of the West Harbor OU remedy in accordance with the Operations, Maintenance, and Monitoring Plan (OMMP) (Hart Crowser, 1997). The OMMP describes the long-term monitoring, maintenance, and contingency plan program for soil and sediment remediation at the West Harbor OU. Routine monitoring (e.g.,

quarterly, semiannual, or annual monitoring/inspections) have been performed at the site and are documented in annual reports (see Section VII, Technical Assessment, for a summary of monitoring results). Monitoring and inspection activities have included:

- Upland Containment and Best Management Practices (BMPs): site inspections, storm water inspections;
- Water Quality: groundwater monitoring, piezometer monitoring, seep sampling;
- Sediment Quality: surface sediment sampling, sediment trap deploy/collect, bathymetric survey;
- Tissue Quality: fish tissue sampling; and
- Habitat Performance: habitat survey, eelgrass monitoring, Schel-chelb monitoring.

Upland Containment and BMPs. The upland area will continue to be inspected annually for adequate site access controls and signs (e.g., "no shellfishing" signs) and condition of the fencing, asphalt concrete cap, and shoreline. Inspection and maintenance procedures will be in accordance with the OMMP. Also, storm water Best Management Practices will be reviewed on an annual basis.

Water Quality Monitoring. Based on OMMP guidance and monitoring results, water quality monitoring is no longer required at the monitoring well, the seep located under Pier A, or the well points. Water quality monitoring will be conducted annually to verify remedial design predictions of limited contaminant mobility within the CDF and to verify the effectiveness of upland source control actions. Water quality monitoring will continue to be conducted at the monitoring well and at all seeps with a discharge greater than 1 gpm. Water levels in the piezometers (inside and outside the CDF berm) will be measured immediately before and after groundwater and seep sampling.

Sediment Quality. Sediment quality will be conducted during Year 8 (2005) in accordance with the OMMP. Sediment quality will consist of surface sediment sampling, sediment trap monitoring, and bathymetric survey of the cap area. Although sediment trap monitoring is not required based on past monitoring results, sediment trap data is useful for interpreting surface sediment data. Sediment sampling will also be performed at the Intertidal HPAH Area located under and adjacent to the Bainbridge Island Ferry Terminal to verify the anticipated natural recovery of HPAH in sediments.

Tissue Quality. Sediment and shellfish tissue monitoring will be conducted during Year 8 (2005) at the Intertidal HPAH Area. The purpose of this monitoring is to verify the

anticipated natural recovery of HPAH concentrations in sediments and to document that sediments and tissue do not exceed risk-based chemical criteria identified in the OMMP.

Habitat Performance. Formal (quantitative) monitoring of the Schel-chelb Estuary and the Harper Estuary (the reference site) will be conducted during Year 7 of estuary monitoring (2003) and Year 10 of estuary monitoring (2006). Monitoring methods will be conducted in accordance with the revised construction/restoration plan (DOT and Hart Crowser 1998) and EPA-approved revisions to the vegetation monitoring methods. In addition, informal monitoring and maintenance (including removal of invasive species) of the Schel-chelb Estuary will be conducted annually.

Based on OMMP guidance and monitoring results, low tide and video surveys of the cap area will not occur in the future. Due to the failure of the eelgrass planting site, a contingent habitat mitigation project will be initiated that will likely include monitoring.

Historically, groundwater elevations within the CDF have been below 10 feet MLLW, but above 8.7 feet MLLW. Although the design of the CDF indicates that the water level was to be maintained at 10 feet MLLW, water levels in the CDF are acceptable down to 8.7 feet MLLW, since all hot spot sediments were placed below 8.7 feet MLLW. Therefore, hot spot sediments should remain in a saturated anoxic environment. As indicated above, this will continue to be monitored.

East Harbor Subtidal Sediment Cap Monitoring

Three monitoring events have been completed on Phase I of the subtidal sediment cap (1995, 1997, 1999) in accordance with the ten year Operations, Maintenance, and Monitoring Plan (OMMP, EPA 1995). The original OMMP goals were: (1) to evaluate the effectiveness of the initial removal action (Phase I cap), (2) to confirm or update data collected during the RI/FS and initial remedial action in those areas not remediated under the Phase I capping event, and (3) to evaluate reductions in contaminant sources to the East Harbor OU. It was intended that further remedial design/action and subsequent long-term monitoring would occur before the end of the ten-year time period outlined in the 1995 OMMP. (See also Section VII, Technical Assessment, for additional discussion regarding subtidal sediment cap and intertidal area monitoring)

Treatment Plant Performance and Compliance Monitoring

Treatment plant performance monitoring is conducted weekly from seven sampling points within the plant. Samples are collected and analyzed for a suite of analytes to effectively monitor the

active portions of the treatment process (Table 7). The analysis includes measurement of chemical concentrations across the three major components of the treatment system to evaluate the treatment efficiency of each (primary, secondary and tertiary). Currently, treatment efficiency across the depurator (primary treatment) is erratic, ranging from 0% - 20%. Treatment efficiency across activated sludge tank (biological secondary treatment) is exceptionally high, ranging between 98% - 99% for PAHs and PCP. Historically, the secondary system was not very efficient, however, once EPA assumed operation of the plant in 1993, this component of the overall system was optimized and now provides the majority of contaminant reduction. The activated carbon system (tertiary system) provides polishing of the effluent prior to discharge.

The most critical samples collected in the performance-monitoring program are used to evaluate contaminant concentrations across the lead carbon vessel. These samples provide early warning that carbon loading is approaching the breakthrough threshold that may require bringing a fresh carbon vessel on-line. The criterion used to determine if a carbon vessel needs to be changed is to compare effluent concentrations of PAHs and PCP across the lead carbon vessel. If the concentration of PAHs and PCP in the lead carbon vessel effluent is over 75% of the concentrations entering the lead carbon vessel, a fresh vessel is brought on-line. This provides for a conservative yet reliable method for assuring that discharge limits are not exceeded.

Compliance monitoring requirements are identified in both the 1988 Consent Decree and the 1991 Unilateral Administrative Order with the Wyckoff Company. These requirements were further modified in the February 2000 ROD for the Soil and Groundwater OUs. The discharge limits are consistent with the fresh water aquatic criteria concentrations established in the National Toxics Rule (40 CFR 131.6). The current discharge limits and sampling frequency are provided in Table 8. Once steam injection begins during the thermal remediation pilot project, compliance sampling will be increased from weekly to daily for the first two weeks. After the first two weeks, the sampling frequency will shift to bi-weekly for the remainder of the first quarter of thermal operations. The change in sample frequency was instituted at the request of the Washington State Department of Ecology (see also Appendix A).

Effluent discharge limits to Puget Sound have never been exceeded. Total PAH concentrations in plant effluent typically vary between 5-10 µg/L without an exceedance of any individual compound. PCP effluent concentrations range between 0.01-0.1 µg/L based on the weekly compliance sampling.

In addition to chemical samples, effluent toxicity samples are collected both quarterly and annually. Quarterly samples are used to conduct a chronic toxicity test for bivalve larvae with either blue mussel (*Mytilus Sp.*) or Pacific oyster (*Cassostrea gigas*). Annual samples are used to

conduct the acute toxicity test for estuarine fish with Inland Silversides (*Menidia beryllina*). Results of both annual and quarterly biomonitoring tests have consistently demonstrated compliance with Washington State discharge limits for toxicity as described in WAC 173-205-020.

Groundwater Levels Monitoring

Groundwater levels are currently monitored monthly to provide Project Managers and technical team members with data to verify hydraulic control of the site is maintained. The collection of water level data from the upper aquifer was initiated upon near completion of the sheet pile containment wall construction in late January 2001. Leakage of the entire sheet pile containment wall was estimated to be about 1 gallon per minute (gpm) with an estimated rainfall infiltration, wall leakage, upland recharge, and lower aquifer recharge of about 20 gpm. As a result, water levels in the upper aquifer were anticipated to increase rapidly after installation of the wall. Monthly water-level measurements from upper and lower aquifer monitoring wells continue to be collected to support decision-making regarding groundwater extraction system operation. Prior to installation of the sheet pile wall, water level measurements were collected quarterly.

The existing treatment system staff under direction of the USACE Site Manager accomplishes monthly field data collection. Water-level data is converted into elevations, organized in a table and interpolated for presentation as water level surface elevation figures (See Tables 9 and 10 for the June and July 2002 Water Level Data, respectively). The data is then analyzed by the USACE Project Hydrogeologist and presented in the monthly operations report.

Procedures for the collection of water level data include:

- All water levels are measured and recorded to an accuracy of one hundredth of a foot.
- All water levels are measured at the same location on the inner casing each time.
- All upper aquifer monitoring well measurements are collected within one hour with lower aquifer monitoring well measurements collected concurrently.
- Monitoring wells suspected of containing LNAPL are measured last. LNAPL thickness is not measured and the top of the LNAPL will be substituted for water level. (Since the NAPL and groundwater densities are similar, the top of NAPL should be nearly the same as the effective groundwater elevation.)
- Well condition will be recorded including presence of LNAPL, recent vault flooding and damage.

Water level monitoring is currently conducted from 19 upper aquifer monitoring wells distributed across the Former Process Area and the portion of the Log Storage/Peeler Area directly south of the Former Process Area. Lower aquifer water level data is collected from all 7 existing monitoring wells completed in the Former Process Area. In addition to the monthly water level data collected from the monitoring wells across the site, the O&M staff record water levels from the active extraction wells during normal inspection rounds on a weekly basis.

Site Inspection

The site inspection was conducted on April 9, 2002 by Travis Shaw, U.S. Army Corps of Engineers Site Manager and Cliff Leeper, Lead Operator for Operations and Maintenance International (OMI), sub-contractor for O&M of the groundwater treatment plant and extraction system. The purpose of the site inspection is to assess the protectiveness of the remedy, including the presence of fencing and gates to restrict access, the status of institutional controls, the condition of the site, and the status of the sheet pile wall and groundwater treatment plant and extraction system. A complete walk-through of the groundwater treatment plant facilities was conducted. The scope of this comprehensive inspection was to verify current status of the existing system, identify maintenance issues, confirm that all documentation associated with site operations and training was current, and to gather information from the plant operators regarding issues that might potentially impact the protectiveness of the remedy.

Observations and issues are summarized in the Site Inspection Checklist, which is included in Appendix H. Photographs documenting site conditions are in Appendix I.

West Harbor Operable Unit

Visual inspection of the surface of the confined disposal facility (CDF) and tidal barrier indicate that they remain in place and functional. Sampling data and sediment surveys of the capped areas confirm that the remedy is functioning well. Fencing and site access is adequately controlled by DOT and "no shellfishing" signs are well maintained. The Schel-chelb habitat estuary continues to provide viable habitat, however, the eelgrass habitat project west of the CDF did not survive.

East Harbor Operable Unit

Sampling data from the 1993-1994 (Phase I) sediment cap indicate that the cap is physically stable, is containing contaminated sediments, and is providing quality habitat. Additional

sediment capping occurred between 2000 and 2002 (Phases II and III). Monitoring of all capped areas and the entire intertidal area surrounding the site will commence in the fall 2002.

Significant contamination still exists in the East Beach intertidal area. At low tides, NAPL seeps are evident in several locations. At this time, containment of NAPL from the upland source has been achieved by the installation of the sheet pile wall. Although the containment has reduced or eliminated the flow of NAPL from the upland to the intertidal area, significant NAPL remains in the East Beach sediments (outside of the sheet pile wall) and will continue to seep for some time. Initial estimates produced during the design of the sheet pile wall estimated that NAPL seeps would continue for up to 24 months after installation of the containment wall. Subsequent investigations indicate that the reservoir of NAPL within the sediments is far larger than previously thought. Consequently, seep activity may continue for a longer period of time than initially estimated.

Despite the existence of NAPL seeps in the intertidal area, habitat function of the East Beach area appears to be good beyond the immediate vicinity of the seeps. Eelgrass meadows exist from approximately 0 MLLW to beyond -3.5 MLLW. The eelgrass beds appear healthy with the presence of both characteristic epiphyte grazers and upper trophic level consumers. Continued monitoring of the East Beach intertidal area will occur with surface sampling under the East Harbor OU Long-Term Monitoring Operations, Maintenance and Monitoring Plan. In addition, if full scale thermal remediation is implemented site-wide, a Thermal Effects Study will occur within 1-2 years of thermal treatment and provide additional data on the benthic community adjacent to the Wyckoff facility, including the East Beach intertidal area.

Soil and Groundwater Operable Units

Wyckoff Facility Conditions: Generally, the treatment buildings and trailers are in good condition. Over the last year, many of the deteriorating wood stairways used to access site trailers were replaced with newer metal stairs. A new building was constructed this year to house the mechanical equipment and boiler required for the steam injection pilot study. In addition, a new pump house was constructed to enclose the new on-site water supply well. The three dilapidated residences on the site were recently demolished. These residences were in very poor condition and represented a significant hazard to trespassers and transients.

The condition of the monitoring wells on-site varies considerably. Several are heavily fouled or have degraded due to construction materials that are incompatible with site contaminants. Conversely, several of the newer wells installed on-site appear to be in good condition. Currently, monitoring wells are only routinely sampled to determine water levels. This data is

used to confirm that hydraulic control is being maintained by the existing liquid extraction system. Prior to beginning steam injection, both upper and lower aquifer wells will be sampled to establish a contaminant baseline. Since all but two monitoring wells are within the fence securing the Former Process Area, individual wells do not have locking well caps. Recent remedial actions outside the perimeter of the Former Process Area have increased access to the two wells outside the fenced portion of the site. Locking well caps will be acquired for these two wells (MW-23 and CW01).

Fencing around the Former Process Area restricts access to the most heavily contaminated portion of the site. Fencing along the northwestern portion were expanded in August 2002. Completion of the Phase III cap, which created an intertidal beach along the northwestern portion of the sheet pile wall, made this area accessible. Authorized Personnel Only and No Trespassing signs are posted at all access points. Despite these measures, occasional vandalism has been a problem, particularly graffiti. The recently completed demolition of the three abandoned houses on-site is anticipated to make the site less of an attractive feature for vandals. In addition, the pole gate at the intersection of the parking lot driveway and the main city arterial leading to the site has been repaired and is now locked each night. These measures will prevent access to the parking lot after work hours and will hopefully reduce vandalism at the treatment plant.

Surface drainage continues to be an issue during storm events, particularly since the installation of the sheet pile containment wall. Storm water issues have been exacerbated by the movement of contaminated soil from the western portion of the site. Consolidation of excavated contaminated soil within the Former Process Area eliminated low areas that provided holding areas for storm water. In response, berms have been constructed around the extraction wells located in low-lying areas of the site to prevent flooding of the extraction wells. In addition, the frequency of water level measurements has been increased to provide site managers with the data required to more fully monitor fluid levels and vary extraction rates to maintain hydraulic control as storm water infiltrates the area within the sheet pile wall.

Treatment Plant and Extraction System: The biggest challenge to operations of the existing treatment and extraction system is corrective maintenance, which results in high operating and maintenance costs. The materials of construction in the treatment plant and the original extraction systems were selected by the PRP. In many cases, the materials were subject to degradation by contaminants being treated by the plant or suffered from corrosion due to the high salinity of upper aquifer groundwater, and deteriorating equipment nearing the end of their service life. As a result, portions of the extraction and treatment system have required unusually high O&M costs to replace components either chemically degraded or corroded from contact with brackish influent groundwater. EPA dedicated significant resources to rebuilding all seven of the original extraction wells during the mid-1990s to address incompatibility problems and

increase extraction efficiency. In addition, an accelerated pump re-build program was initiated to prepare the existing treatment facility for higher operating flow rates anticipated during the steam injection pilot project. EPA also implemented additional major maintenance, repair, and replacement of equipment in the treatment plant in August 2002 to ensure that the system will continue to function during the steam injection pilot project and through the period in which EPA will make a decision regarding the final groundwater remedy (i.e., full-scale thermal remediation or containment).

Many of the tanks in the treatment plant have experienced accelerated rates of corrosion, which has reduced wall thickness in some of the large equalization tanks. Of particular concern is the old biofilter tank (T-205), which is used as a wet-well for the P-205 pumps. This tank is heavily corroded and is showing signs of structural instability and failure. This tank will be replaced prior to the beginning of steam injection. Several of the tanks were also damaged during the Nisqually earthquake last year (February 2001). Repairs to the effluent tank (T-303) were recently completed and work to clean, seal and re-secure the equalization tanks (T-401 and T-402) were completed in August 2002.

Compliance and performance samples for operation of the existing groundwater treatment plant are collected by the O&M contractor and shipped to the EPA Region 10 Laboratory at Manchester on a weekly basis. Preliminary data is reported by the laboratory within the same week to provide the plant operators with timely information regarding effluent discharge chemistry. Final data packages, including a Data Quality Assurance Report are submitted to EPA and USACE approximately 30 days after sample collection. The USACE Site Manager also submits monthly system operations reports to EPA. The July Groundwater Extraction and Treatment System Operations Report is included in Appendix J. There have been no significant data quality issues since EPA assumed operation of the systems in 1993.

Hydraulic Control: Generally, the existing treatment and extraction systems are performing as intended in maintaining hydraulic control of the Former Process Area. Evidence for effective containment is provided by the monthly groundwater level measurements. Tables 9 and 10 show the water level measurements in the upper and lower aquifers for June and July 2002, respectively. Based on this data, the hydraulic control has been maintained across the Former Process Area. Indications are that pumping from the existing extraction system is sufficient to induce an inward gradient (towards the extraction wells) within the contaminated upper aquifer and an upward gradient from the lower aquifer to the upper aquifer. The level of hydraulic control is further supported by the presence of the sheet pile wall, which provides a physical barrier to both NAPL and dissolved phase contaminant migration from the Former Process Area to Puget Sound and Eagle Harbor.

Contaminant concentrations in groundwater are not declining due to several factors. First, installation of the sheet pile wall provides a physical barrier that prevents the intrusion of seawater into the upper aquifer during high tides. Consequently, less mixing of groundwater is occurring, which has reduced the dilution of contaminated groundwater. Secondly, the presence of a physical barrier has potentially increased the efficiency of the existing wells in capturing both contaminated groundwater and NAPL. This is indicated by the increase in contaminant concentrations in groundwater and increased NAPL recovery over the last 9 months.

The key to maintaining hydraulic control of the site is to continue operation of the existing treatment and extraction system. This task is complicated by the poor condition of several treatment plant components. The spare parts list for the facility needs to be expanded and upgraded to assure that critical parts are on-site in the event an unanticipated failure results in the need to shut down the treatment plant. The O&M contractor was tasked with identifying key components that could result in a shut down of the extraction system or the treatment plant and to develop a critical parts list. Development of that list is completed and acquisition of critical parts will be completed prior to the start of steam injection within the pilot area.

Sheet Pile Containment Wall: The sheet pile containment wall appears to be in good condition without any visible signs of settlement or alignment displacement. Approximately 3 months after installation, a modified pumping test was conducted at the monitoring wells installed at 8 locations along the outer sheet pile wall. The conductivity of the wall was higher than anticipated during design but consistent with published data on other sheet pile walls using interlocking joints. It is anticipated that the interlock joints will continue to become less permeable over time due to clogging with fine soil particles. In addition, the sheet pile wall monitoring wells are checked for NAPL intrusion with an oil/water interface probe. NAPL intrusion was not detected across any of the interlock joints monitored. (See also Section VII, Technical Assessment, Question A, Sheet Pile Containment Wall.)

Interviews

In April 2002, EPA conducted informal interviews with selected community members and with a representative from the Bremerton-Kitsap County Health District (see Community Notification and Involvement, above). In May 2002, EPA conducted interviews with representatives from the City of Bainbridge Island and the Suquamish Tribe. The NOAA Restoration Center, the Washington State Department of Natural Resources (DNR), and the Washington State Department of Fish and Wildlife (WDFW) (the Natural Resource Agencies) provided input to

the five-year review in August 2002. Notes from interviews with the City of Bainbridge Island, the Suquamish Tribe, and input from the Natural Resource Agencies are included in Appendix E.

VII. TECHNICAL ASSESSMENT

Question A: Is the remedy functioning as intended by the decision documents?
(See Section IV, Remedial Actions, Remedy Implementation, for a detailed description of the remedies for each operable unit.)

West Harbor Operable Unit

In general, the results of monitoring indicate that overall the remedy is functioning as designed:

- Water quality monitoring indicates that, with few exceptions, levels of mercury remain below the criteria. Dissolved mercury concentrations - the most important indicator of remedy performance - have remained well below the criteria. Total mercury, in some instances has exceeded the criteria, but the correlation between these exceedances and turbidity levels is consistent. Results of water quality monitoring indicate that the CDF is performing well.

- Control of groundwater upland of the containment area, and control of surface runoff has been consistently maintained through upkeep of the cut off drain, and through maintenance of the asphalt cap and oil/water separators.

- Visual inspection of the tidal barrier and the berm face continue to confirm the fact that they remain viable and in place.

- Sediment surveys and sampling confirm that capped areas remain in place and that concentrations of contaminants remain, by and large, below the criteria.
- Monitoring of the Schel-chelb habitat estuary continues to indicate that the site is functioning well and providing viable habitat.

However, two areas need to be addressed:

- Seeps in the area of the old landfill contain constituents above water quality criteria, and;

- Eelgrass west of the CDF has not survived, so additional habitat mitigation is needed.

These areas are discussed below under Recommendations and Follow-up Actions. Fencing and site access is adequately controlled by DOT and "no shellfishing" signs are well maintained.

East Harbor Operable Unit

Subtidal Sediment Cap. At this time, the following information exists regarding the cap:

- The majority of the Phase I subtidal cap is effective in terms of physical stability, providing quality habitat, and meeting Washington State Sediment Management Standards criteria;

- Data pertaining to the uncapped areas of the harbor was collected in September 2001 and Phase II and III final remedial activities in those areas were finished in 2002; and

- Migration of the upland contaminant source has been minimized by installation of a sheet pile wall (see Sheet Pile Containment Wall discussion, below).

Results indicate that site conditions and cap performance meet the environmental performance standards of the East Harbor ROD for the northern portion of the subtidal cap.

A permanent Regulated Navigation Area, also known as a No Anchor Zone, was established by EPA, the Washington State Department of Natural Resources (DNR), and the U.S. Coast Guard in 1999 to preserve the integrity of the subtidal sediment cap and prohibit activities that would disturb the seabed such as anchoring, dredging, or laying cable. The regulated navigation area is enforced by the U.S. Coast Guard. Four signs were placed by DNR on buoys in the harbor designating the regulated navigation area. This fall, EPA will be posting additional signage near the mouth of Eagle Harbor restricting activities that might disturb the subtidal sediment cap. EPA is also coordinating with the Harbor Master to ensure that obvious violations do not occur.

Since the initial five years of sampling indicates that no criteria have been exceeded, continued monitoring in the northern portion of the cap will not occur with the exception of confirmation samples and bathymetry. Confirmation sampling will provide final evidence that Phase II and III capping activities have not negatively disturbed the original cap area. Bathymetric surveys will continue to occur over the entire cap area. Results from two specific sampling locations in the southern portion of the Phase I cap indicated degraded conditions over time (see discussion regarding Question C, below). A lack of source control and unknown subsurface conditions limited interpretation of monitoring results meant to determine potential mechanisms of

recontamination or degradation. Therefore, the southern portion of the Phase I subtidal cap will continue to be monitored. Areas remediated in Phase II and III will also be monitored in future events. Additionally, the update to the 1995 OMMP is currently being finalized to allow a more focused monitoring strategy over the next ten years. The first sampling to be conducted under the updated OMMP will occur in the fall of 2002.

Intertidal Areas. Four intertidal areas exist around the perimeter of the Wyckoff site. The areas are artificially separated for monitoring purposes but together represent continuous intertidal habitat surrounding the site. The areas are described here in an east to west direction:

- Area 1, known as the East Beach, contains significant contaminant seeps and was identified in the 1994 East Harbor ROD for monitored natural recovery, after upland source control has been achieved;

- Area 2, known as the North Shoal, is naturally occurring and contains very minimal contamination;

- Area 3, known as the intertidal cap, was created during the capping of highly contaminated subtidal sediments in the former log-rafting area; and

- Area 4, known as the mitigation beach, is adjacent to the intertidal cap and was created as mitigation for habitat taken during installation of the sheet pile wall.

The entire intertidal area surrounding the facility will be included in future monitoring events under the revised OMMP.

Physical stability of the entire intertidal area will be monitored with topographical surveys. The beach profiles provide measures of the instantaneous conditions of the intertidal area at the time of the survey. To assess time-integrated changes in intertidal sediment distribution, dyed or traceable synthetic sediments may be placed at discreet locations in the intertidal areas and monitored for dispersion. This data will augment the profiles of intertidal beach elevations.

The entire intertidal and riparian area will also be surveyed for wildlife use. Comprehensive presence/absence surveys for use by birds, mammals, and fish will occur twice yearly for the first five years.

East Beach. At this time, significant contamination still exists in the East Beach portion of the East Harbor intertidal area. Previous studies suggest the following: (1) it is not likely that

unaided natural recovery will achieve cleanup objectives in the ten year time period stated in the ROD, (2) remedial alternatives are either ineffective, costly, or more harmful to human health or the environment than existing conditions, (3) it is unknown how potential temperature changes resulting from possible upland thermal remediation will affect natural recovery efforts in the intertidal area, (4) conclusions about contaminant flux may not accurately reflect physical conditions affecting contaminant transport on the intertidal areas.

EPA will continue to monitor contaminant concentrations in the top ten (10) centimeters of the East Beach intertidal sediments to determine if natural recovery, aided by source control and upland thermal remediation, can achieve the cleanup goals established in the ROD. EPA will reassess current information after the start of upland thermal remediation (if this technology is implemented site-wide) to determine the state of the beach and if additional studies are necessary.

The remedial action objectives for intertidal surface sediments (top 10 cm) are the MCUL for PAHs with an EPA developed supplemental objective of 1,200 µg/kg (dry weight) total high molecular weight polycyclic aromatic hydrocarbons (HPAH). The supplemental cleanup objective was instituted to address human health risks from consumption of contaminated shellfish in intertidal areas. Intertidal sediments must meet both objectives within 10 years of significant upland source control, which occurred on February 15, 2001. (See discussion on sheet pile wall construction, above.)

In 1997, a natural recovery study was conducted for the East Beach intertidal area to assess the viability of this alternative at meeting cleanup objectives. The study concluded that: (1) although bacterial communities in the East Harbor OU intertidal sediments are capable of degrading PAHs, microbial degradation alone will likely not achieve the cleanup goals described in the ROD for the East Harbor across the full range of PAH concentrations measured in all intertidal sediments; (2) sediments that do not contain free product in the intertidal area north and east of the Wyckoff facility have the potential to achieve the MCUL remediation goal within ten years for LPAHs but not HPAHs. However, sediments that currently contain free-flowing NAPL will probably not meet the LPAH or HPAH remediation goals; and (3) sediments contaminated with HPAHs above the supplemental cleanup goal (1,200 µg/kg dry weight) are likely to persist well beyond the ten-year natural recovery period.

In 1999 and 2001, EPA conducted investigative sampling on the East Beach to assess the vertical and lateral extent of contamination for evaluation of the appropriate remedial actions in the intertidal area. Due to the continuous nature and depth of contamination on the East

Beach, excavation of hot spots is no longer considered a viable alternative. The investigations determined that the area of required excavation is approximately 13,000 cubic yards. The extent and depth of excavation are too large for technically practicable removal without significant ecosystem impacts, human exposure, and high costs.

East Beach area monitoring will focus on collecting data required to determine contaminant concentrations in the top 10 cm of sediment (zone of compliance). Monitoring will include visual inspections of the area to determine the presence or absence of intertidal seeps, analysis of surface sediments to determine existing contaminant concentrations and evaluate LPAH model predictions, and analysis of subsurface samples between 0 and -2 ft MLLW.

The overall purpose of the East Beach monitoring is to determine:

- If contaminant concentrations decrease over time and if so, evaluate the rate of natural recovery
- Ecological baseline risk (post upland source control) by collecting clam tissue samples for analysis
- The effect of possible upland thermal remediation (temperature increase in the intertidal area) on natural recovery
- If the East Beach area will naturally recover within the 10 year time frame stated in the ROD, and
- The stability of the East Beach over time.

North Shoal. The North Shoal area will be monitored for elevation changes, visual seeps and habitat functionality at the same times that these activities occur in adjacent areas. Although the north shoal has been relatively stable over time, consistent surveys along with adjacent areas will provide information regarding littoral drift throughout the entire intertidal area. Although mobile NAPL exists on the north shoal at depths below 15 feet MLLW, visible seeps have not been observed in the majority of this area. One seep has been periodically visible on the east side of the north shoal and is likely related to the visible seeps on the north end of the East Beach. It is assumed that the amount of overlying material on the north shoal acts as a "natural cap" to contain the NAPL at depth.

To assure that the North Shoal area does not contain contaminants in the top 10 cm of sediment, 4-6 surface sediment samples will be collected and analyzed during the 2002 monitoring event. To confirm that the North Shoal area remains clean and that the East Harbor ROD requirements are met, surface sediment samples will also be collected and analyzed during a later monitoring event.

Intertidal Cap. The intertidal cap will be monitored in the fall of 2002 for the first time since it was placed. The intertidal cap is approximately 3-20 feet thick and was designed for two purposes: (1) to cover highly contaminated subtidal sediments from the southern portion of the 1994 cap to the shoreline, and (2) to connect adjacent intertidal areas and provide continuous intertidal habitat along the Wyckoff shoreline. It therefore performs both sediment cap and habitat functions. The intertidal cap will be monitored for: (1) physical stability, (2) habitat functionality, and (3) surface contaminant concentrations to evaluate ecological and human health risks. The first two functions will be monitored as described for the North Shoal (see above). Ecological and human health risks will be monitored as described above for the East Beach.

Habitat Mitigation Beach. The mitigation beach will be monitored in the fall of 2002 for the first time since it was placed. In general, the mitigation beach will be monitored to provide information on gradual changes in the engineered design and/or habitat use over time. It is expected that beach sediments will vary in elevation due to tides, large storms, and other naturally occurring events over time. It is also expected that habitat use will vary with time, buffer zone successional/growth stage, and uncontrollable events such as weather and human activities in adjacent areas. However, large or unexpected changes will act as triggers to EPA to investigate and determine if additional remedial actions are necessary.

The mitigation beach area will be monitored to determine: (1) physical stability, and (2) habitat functionality including a visual survey of plantings in the buffer zone and the entire intertidal area. Buffer zone plants will require watering during dry summer months for the first year and during times of drought for the next 2 years. In addition, periodic refuse pick-up will occur throughout the intertidal area surrounding the site. Collection and analysis of surface sediments will not be part of the monitoring program. Sediments used to construct the mitigation beach were chemically tested prior to construction of the beach and determined to be free of contamination and suitable for intertidal habitat creation.

Numerous signs warning about the danger associated with the consumption of fish and shellfish from the harbor and adjacent beaches are prominently displayed around the site perimeter in multiple languages. The fish and shellfish advisory was originally issued by the Bremerton-

Kitsap County Health District. EPA communicated the advisory by posting and maintaining the warning signs. Access to the beach areas are also restricted to the extent possible by signs.

Soil and Groundwater Operable Units

Groundwater Treatment Plant and Extraction System. The existing groundwater treatment plant and extraction system is functioning as intended. In many regards, the existing treatment and extraction system is achieving many of the remedial action objectives of the Groundwater Operable Unit despite the fact that it represents only a partially complete remedy. In combination with the sheet pile containment wall, the existing groundwater treatment plant and extraction system is ensuring that contaminant concentrations in the upper aquifer groundwater are not leaving the Former Process Area. Evidence to support this is provided by the monthly water level monitoring conducted across the Former Process Area. This monitoring indicates that the current pumping rates are maintaining hydraulic control across the site by producing an inward gradient (towards the extraction wells) within the contaminated upper aquifer and an upward gradient from the lower aquifer to the upper aquifer. The containment of contaminated groundwater eliminates adverse impacts to marine water quality, aquatic life, and the lower aquifer. In addition, the contaminated upper aquifer groundwater is not being used for human consumption or any industrial purpose, which eliminate human contact with contaminated groundwater with the exception of potential exposure to site workers.

The existing treatment and extraction system also addresses the remedial objective for the reduction of the NAPL source and quantity of NAPL leaving the upper aquifer beneath the Former Process Area. Approximately 100,000 gallons of NAPL has been recovered by the existing extraction system since the system began operation in 1990. Combined with the sheet pile wall, the upland source of NAPL migration to the marine environment surrounding the site has been effectively controlled. However, it is estimated that the NAPL that had migrated off-site prior to installation of the sheet pile wall will continue to be released from sediments on the eastern shoreline for the next 24 months (see the previous discussion of the East Beach). Since the existing extraction system is not expected to remove large quantities of NAPL, which is the principle threat at the site, the more aggressive remedy represented by thermal remediation is necessary to fully achieve a significant reduction in NAPL, if it is a feasible technology.

Groundwater extracted from beneath the Former Process Area to maintain hydraulic control of the site is treated to meet the standards of the February 2000 ROD for the Soil and Groundwater Operable Units, which describes discharge limits for the existing groundwater treatment system. The existing treatment plant has treated and discharged to Puget Sound approximately 370 million gallons of groundwater without exceeding any contaminant or water quality standards.

Ambient air quality emissions impact was estimated in 1997 at the treatment plant using an air dispersion modeling program. Results were compared to the Acceptable Source Impacts Levels (ASILs) presented under the Puget Sound Air Pollution Control Agency (PSAPCA) Regulation III. No exceedances were indicated for volatile organic compounds (VOCs). No ASILs were exceeded for PAHs or PCP based on air emissions for the aeration basin. Some exceedances for naphthalene and PCP were indicated at the depurator. Therefore, respirators were used by on-site workers when tank maintenance was performed. The depurator has since been replaced by a dissolved air flotation unit (DAF) (see next paragraph). Additional air monitoring will occur during the steam injection pilot project.

While the current extraction and treatment system is successfully meeting many of the remedial objectives for the site, the success may be short term. The original materials of construction of both systems were selected by the PRP and have proven to be incompatible with both the environment and contaminants found on site. The location of the site adjacent to Puget Sound and Eagle Harbor results in brackish groundwater within the upper aquifer groundwater treated by the existing system. Consequently, many of the tanks, pipes and pumps in the treatment plant have experienced accelerated rates of corrosion. In addition, many of the pipe runs in the original extraction and treatment system were constructed of PVC, which degrades after prolonged contact with site contaminants. As a result, O&M costs have increased to address corrective maintenance problems. This situation has been partially mitigated by preparations for the steam injection pilot project to replace or rebuild potions of the existing system most in need of maintenance. For example, a depurator provides the primary treatment component of the existing treatment system. The depurator has largely ceased to function over the last 6 months. Fortunately, increased contaminant concentrations anticipated during the steam injection pilot operations required replacement of the depurator with a more efficient DAF unit. EPA recognizes that the existing treatment and extraction system will require replacement as part of either a final containment remedy or implementation of thermal treatment site-wide.

Contaminated Soil Removal. As discussed in Section IV, Remedial Actions - Remedy Implementation, contaminated soil from the Former Log Storage/Peeler Area and the Well CW01 Area were removed and consolidated within the Former Process Area prior to completion of the pilot study project. EPA is currently working with state counterparts at the Washington State Department of Ecology to demonstrate compliance with MTCA Method B cleanup levels for soils across the site outside of the Former Process Area. Once confirmed, the areas of the site outside the Former Process Area would meet all of the remedial objectives for the Soil OU. Contaminated surface soil remaining on-site is within a fenced perimeter that prevents uncontrolled access and eliminates potential chemical exposure to the public. The only potential human exposure is to site workers, who receive training consistent with the Site Specific Health

and Safety Plan and use appropriate personal protective equipment (PPE) when engaged in activities that could result in contact with contaminated media.

Sheet Pile Containment Wall. The sheet pile wall is functioning as intended and is meeting the goal of limiting lateral migration of contaminants into Eagle Harbor and Puget Sound. Sheet pile leakage was evaluated in April 2001. In order to obtain direct measurements of sheet pile leakage, joint observation wells were installed, during construction, every 200 feet along both the outer and pilot area walls. The joint observation wells consist of 6-inch-wide by 5-inch-deep steel channels (5.25 inch by 4.625 inch inside dimensions) welded over the pile interlock, on the seaward side of the sheet pile wall (Figures 12 and 13). The joint observation wells cover the entire interlock from the top of the pile to 5 feet above the bottom of each pile.

Sheet pile leakage rates are influenced by several factors:

- Joint (interlock) geometry
- Deformation as a result of driving or lateral displacement of piles
- Joint-sealing materials
- Plugging of interlocks by soil during driving, or sedimentation in interlocks after installation.

Since thermal treatment methods will be used for the Wyckoff site, sealants were not used in the pile interlocks.

Pumping tests were performed on all of the joint observation wells in April 2001 to assess the hydraulic conductivity of the Frodingham No. 5 sheet pile walls. Based on the results, the overall average equivalent hydraulic conductivity of the sheet pile walls installed at the Wyckoff site is consistent with published test data. In addition, the absence of NAPL in the joint observation wells during the testing indicates the wall itself may be adequate as is, if needed for long-term containment. Finally, the hydraulic conductivity of the outer wall should decrease with time as interlock sedimentation proceeds and as finer sediments are introduced to the interlocks.

Steam Injection Pilot Study. Construction of the steam injection pilot study is substantially completed. Equipment start-up and testing began on September 16, 2002 with full operation targeted to begin by the end of September. At this time, the system cannot be evaluated to determine if the remedy is functioning as intended by the decision document (the February 2000 ROD).

Institutional Controls. As mentioned above, the contaminated upper aquifer groundwater within the Former Process Area is not being used for human consumption or any industrial purpose. The sheet pile wall and fencing around the Former Process Area restricts access to the most contaminated portion of the site. Additional fencing was installed in August 2002 to discourage access to the facility via the beach at low tides. All access points to the facility are secured with locked gates and signs. These institutional control measures will continue to be maintained and enforced by EPA.

As discussed under Section III, Background - Initial Response, the Wyckoff facility is held under an Environmental Trust established by the 1994 Consent Decree. It is possible that the Trust will liquidate this property within the next several years. EPA will ensure that measures are in place to restrict the use of the upper aquifer groundwater outside the Former Process Area and the lower aquifer until protective levels are reached. EPA will also ensure that the upper aquifer groundwater within the Former Process Area remains unused due to contaminants that may remain after thermal treatment or will remain as part of the contingency remedy.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of remedy selection still valid?

West Harbor Operable Unit

Cleanup levels, RAOs and all criteria and assumptions used in the design, implementation and monitoring of the West Harbor OU remain valid and protective.

East Harbor, Soil, and Groundwater Operable Units

Generally, the exposure assumptions, toxicity data, cleanup levels and remedial action objectives used at the time of the remedy selection are still valid. While the State of Washington has revised the Model Toxics Control Act or MTCA regulations, these changes do not call into question the protectiveness of the selected remedy, and thus, the ARARs and cleanup levels do not need to be changed.

The original Human Health Risk Assessment (HHRA) for the site was conducted prior to the formal adoption of the Risk Assessment Guidance for Superfund (RAGS). Despite this, the HHRA detailed in the original RI/FS did use exposure factors consistent with the guidance. In addition, both average and Reasonable Maximum Exposures (RMEs) scenarios were calculated for each exposure pathway. Consequently, the underlying methods used to characterize

exposure to site contaminants remain valid even though the HHRA was scoped and conducted approximately eight years ago.

Review of toxicity data did not uncover any changes in toxicity factors for contaminants of concern used in the HHRA with two exceptions. Both the reference dose for chronic oral exposure and the reference concentration for inhalation exposure for naphthalene were updated in the Integrated Risk Information System (IRIS) database in September 1998. IRIS is the primary toxicity data source used in human health risk assessments. However, this change does not alter the protectiveness or validity of the HHRA used to support the selected remedy since naphthalene was already one of the primary non-cancer risk drivers for soil and groundwater exposure scenarios. In addition, EPA is in the process of re-evaluating the exposure and human health risks associated with dioxins and related compounds. This reassessment is still in draft form and may need to be considered during the next five-year review.

Cleanup levels listed in the September 1994 and February 2000 RODs are still valid and protective for the East Harbor OU and Soil and Groundwater OUs, respectively.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

West Harbor Operable Unit

As indicated above, monitoring of the West Harbor OU has revealed that certain seeps in the area of the old landfill contain constituents above water quality criteria. Based on the consistent exceedances for these constituents, EPA has tasked DOT, per the contingency strategy outlined in the site OMMP, to propose options for mitigating this seep water discharge. Seep mitigation options will be presented to EPA for review and consideration by October 2002.

While this is an issue which must be addressed, it does not call into question the protectiveness of the remedy as a whole. The remedy, as designed and implemented, is functioning well. The contaminated seep water discharge discussed above is the result of tidal outflow in areas beyond the extent of the tidal barrier or berm. In short, the upland cut-off drainage system and the tidal barrier, as all constructed elements of the remedial action, are performing the tasks for which they were designed. Additional steps will be taken by DOT to extend the overall remedy and mitigate the contaminated seep discharge.

East Harbor, Soil, and Groundwater Operable Units

Several issues may impact the long-term protectiveness of the remedy. These issues include:

- Service life of the existing groundwater treatment plant and extraction system located on the former Wyckoff facility.

- Integrity of the aquitard providing natural containment beneath the Former Process Area of the Soil and Groundwater OUs.

- Monitoring of the existing subtidal sediment cap in the East Harbor OU.

As discussed above and in Appendix H (Site Inspection Checklist), the service life and continued maintenance challenges of the existing groundwater treatment plant are well established concerns at the site. The other two items listed above are more recent issues that have developed during the course of either pre-design or pre-construction investigations and during Long-Term Monitoring of the sediment cap.

Treatment Plant Lifespan

Since EPA assumed responsibility and operations of the treatment plant and extraction system in 1993, significant repair, maintenance, and replacement of system components have been implemented. However, major concerns exist regarding the long-term viability and functionality of the systems. Much of the equipment have reached or are nearing the end of their service life. Although EPA will be replacing some tanks, pipes, and equipment within the treatment plant as part of preparation for the steam injection pilot study, the goal is to keep the plant operational until a final groundwater remedy is constructed. Regardless of whether EPA expands thermal remediation to full-scale site-wide or if the containment remedy is implemented, the treatment plant will have to be replaced. However, the new system may be different in size and treatment components depending on the final groundwater remedy. Until the decision is made and the new treatment system is designed and constructed, the current system must operate until approximately the year 2005.

Integrity of the Aquitard

Available data indicates that the aquitard generally ranges from 10 to 40 feet in thickness. There are isolated areas where the aquitard may be as little as 4 feet thick, but borings in those areas appear to have terminated in sand lenses within the aquitard and not in the lower aquifer itself. Boring logs indicate considerable variability in the amount of sand present in the aquitard. In either case (thin aquitard or presence of sand lenses), the competence of the aquitard should be

regarded as uncertain in isolated locations. A thin aquitard may prove to be less of a barrier to NAPL migration than would be the case for most of the site. Similarly, depending on the degree of interconnection, the presence of sand lenses could provide preferential pathways for NAPL migration. It should be noted that two monitoring wells (99CD-MW02 and 99CD-MW04), completed during the NAPL Field Investigation conducted in 1999, were installed in borings where NAPL was observed within a few feet of the lower aquifer. To date, though, there is no evidence to indicate that NAPL has completely penetrated the aquitard. The lower aquifer will be monitored monthly during the first several months of the pilot steam injection project and quarterly once steam injection has ceased. Based on laboratory studies, density of NAPL decreases with increasing temperature, thus, it is believed that DNAPL would become less dense and would tend to float (i.e., become LNAPL). Coupled that evidence with aggressive contaminant extraction and monitoring during operations, it is not anticipated that contaminants will be pushed further into or through the aquitard. If EPA decides not to implement thermal remediation across the entire Former Process Area, then a more complete evaluation of the aquitard may need to be completed to ensure protection of the lower aquifer from NAPL intrusion over the long-term.

East Harbor Sediment Cap

In general, the sediment cap is performing as intended to isolate contaminated sediments and provide high quality habitat. However, surface and subsurface PAH concentrations have increased over time at three locations. Surface PAH concentrations increased at two sampling locations on the sediment cap (T8-4 and T9-2) out of a total of 25 sampled locations. Statistical analysis of the data suggest that the pattern of contamination found at these locations does not occur elsewhere on the cap, and that surface contamination is likely to be localized around these two areas.

Subsurface sediment PAH concentrations increased at the two locations above plus one additional location (T7-10, T8-4, T9-2) out of a total of eight locations. The subsurface contamination increased with increasing depth in the cap. Several processes could produce this subsurface contaminant profile, including potential upward vertical migration of contaminants from the native sediment into the cap, mixing of the contaminated material with cap sediments during cap construction and/or physical mixing of the contaminated native sediments with cap sediments through post-construction, and intrusive activities such as anchor drags and boat moorings. In addition, during the monitoring periods in which this data was collected, source control had not yet been achieved, therefore, direct contamination was also possible.

Although this data indicates localized surface and subsurface contamination at three sampled locations, it does not appear to be indicative of the entire cap area. Overall, most sampling locations show little or no change in surface and subsurface PAH concentrations. All three of the locations discussed here received additional cap material during the Phase II and III capping events and will be evaluated again during the next round of monitoring scheduled to begin in the fall 2002.

VIII. ISSUES

Below are issues that result from the Five-Year Review.

Issue	Currently Affects Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
West Harbor Operable Unit		
Seeps in the area of the old landfill contain constituents above water quality criteria which may contaminate the cap nearby	N	Y
Eelgrass planting site west of the CDF did not survive	N	N
East Harbor Operable Unit		
Significant contamination still exists in the East Beach area (the contamination was expected in the September 1994 ROD)	N	Y
Need to confirm that the North Shoal area does not contain contaminants in the top 10 cm of sediment	N	N
Localized surface and subsurface PAH concentrations on the subtidal sediment cap have been measured	N	Y
Soil & Groundwater Operable Units		
Existing treatment plant and extraction system is nearing its service life	N	Y
Competence of the underlying aquitard is uncertain in isolated locations	N	Y
Future land use (proposed and actual zoning changes)	N	N

Issues Identified from Interviews and Natural Resource Trustees Input (See Appendix E)

Agency	Issue
City/NOAA/ WDFW	Uncertainty of available funding for future cleanup actions, particularly for the potential full-scale thermal remediation project
Suquamish Tribe	A Suquamish Tribe fish consumption survey was completed in August 2000 which shows Tribal consumption levels higher than the RME exposure assumptions used in the Human Health Risk Assessment
Suquamish Tribe	Contaminant levels in geoduck tissues collected from commercial geoduck tracts to the southeast of the site are above human health risk levels
Suquamish Tribe/WDFW	Need to protect nearshore habitat (both aquatic and riparian) and sediment cap from future uses that may degrade the sediment cap, nearshore habitat, or sediment and water quality
Suquamish Tribe	The effects of heat to aquatic biota outside of the sheet pile wall as a result of potential full-scale thermal operations
City/DNR	How is the No Anchor Zone restriction communicated to boat owners, coordinated between agencies, and enforced?

City	Can the size of the No Anchor Zone be reduced to just the area where the sediment cap exists?

IX. RECOMMENDATIONS AND FOLLOW-UP ACTIONS

(A detailed discussion of recommendations and follow-up actions for each operable unit follows this table.)

Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date
West Harbor Operable Unit				
Seeps in the area of the old landfill	Seep discharge mitigation alternatives are being developed. One alternative under consideration is the addition of capping material in seep areas.	DOT	EPA	Spring 2003
Eelgrass site did not survive	Alternative contingency actions are being evaluated (see below for detailed discussion)	DOT	EPA	Spring 2003
East Harbor Operable Unit				
Significant contamination still exists on the East Beach	Continue to monitor contaminant concentrations to determine if natural recovery, aided by source control and potential upland thermal remediation, can achieve cleanup goals established in the ROD	EPA	EPA/Ecology	Fall 2002 and yearly
Need to confirm the North Shoal does not contain contaminants in the top 10 centimeters	Monitor in the upcoming sampling event.	EPA	EPA/Ecology	Fall 2002
Localized surface and subsurface PAH concentrations on the subtidal sediment cap have been measured	Locations will be sampled and evaluated in the fall 2002 monitoring event and will be monitored closely in subsequent years	EPA	EPA/Ecology	Fall 2002

Soil and Groundwater OUs				
Existing treatment plant and extraction system is nearing its service life	Monitor the systems closely and perform repair and maintenance activities	EPA	EPA/Ecology	Ongoing
	Replace the systems for either full-scale thermal remediation or containment	EPA	EPA/Ecology	2005
Competence of the aquitard is uncertain in isolated locations	Monitor lower aquifer on a regular basis	EPA	EPA/Ecology	Monthly/ Quarterly
	Conduct a thorough evaluation of the aquitard to ensure ongoing protection of the lower aquifer	EPA	EPA/Ecology	2004
Future land use (proposed and actual zoning changes)	Continue to coordinate with local officials to ensure that the remedy is protective of future site uses	EPA	EPA	Ongoing

Recommendations Based on Community Involvement

Following are some recommendations that emerged based on interaction with the community during the Five-Year Review process. (See Section VI, Five-Year Review Process, Community Notification and Involvement.)

Recommendations	Party Responsible	Oversight Agency	Milestone Date
Coordinate with the Bremerton-Kitsap County Health District regarding the harbor harvest restrictions. Provide an update to the community	EPA	EPA	Winter 2002
Continue to share information with nearby community and the City about the on-site and local well water testing	EPA	EPA	Ongoing
Share results of the pilot study with the community as they become available, including information such as noise and air quality	EPA	EPA	During Pilot Project
Consider placing an informative sign/billboard outside the site explaining cleanup activities	EPA	EPA	Winter 2002

West Harbor Operable Unit

As mentioned above two areas need to be addressed:

- Seeps in the area of the old landfill contain constituents above water quality criteria which may contaminate the cap nearby, and
- Eelgrass west of the CDF has not survived, so additional habitat mitigation is needed.

Seep Area Near Landfill. Intertidal seeps SP-02 and SP-04 (Figure 14) contain dissolved copper and zinc concentrations above acute water quality criteria, and there is no apparent downward trend in concentrations. In a landfill, the reducing environment tends to bind up metals such as copper and zinc in sulfide complexes. When oxygenated seawater come in contact with the solid waste, it may increase the solubility of these metals. The data indicate that the seeps are localized and are from the margins of the landfill tidal barrier, which is consistent with the occurrence of tidally driven marine water seeps.

In order to mitigate seep discharge from SP-02 and SP-04, DOT is currently developing a recommended alternative. One alternative under consideration is the addition of capping material in seep areas. Based on the geochemical processes controlling copper and zinc mobility, a shoreline embankment system could be designed to restrict tidal mixing and associated oxygen transfer to the waste in the landfill. Because of tidal fluctuations, a relatively thick (3+ feet) cap constructed from fine sands would be needed to displace the zone of seawater penetration outward from the landfill edge. The embankment would be constructed by filling in the existing nearshore area in the vicinity of the seeps with clean sandy material, restoring a gently sloping beach to the area. A geomembrane may be needed prior to filling the SP-04 area.

The upper portion of the shoreline fill could be planted with emergent marsh vegetation. This type of vegetation grows in a narrow band of elevation based on the degree of tidal inundation it requires. The substrate in this upper area would consist of two lifts of material, including a base sand layer and an upper topsoil layer capable of moisture retention.

DOT's recommended alternative will be presented for EPA review and consideration by October 2002. Upon EPA approval, DOT will proceed with design and implementation

of the remedy under EPA oversight. A full schedule for design and implementation will be contained in the proposed alternative presentation.

Eelgrass Habitat Restoration. A 0.6-acre eelgrass transplant site was established immediately west of the CDF and cap in September-October 1998, after water quality surveys and laboratory experiments in 1997 indicated that this location would support eelgrass growth. This mitigation is required for filling the intertidal area during construction of the CDF, as part of the original remedy. Approximately 10,000 eelgrass shoots were planted in 1998, and an additional 220 shoots were planted in April 2000. All eelgrass was lost by August 2000. The eelgrass bed failed, in large part, due to the persistent presence of algae, which prevented light from reaching the newly planted eelgrass. Eight alternative contingency actions for habitat mitigation were evaluated by EPA, Ecology, Washington State Department of Fish and Wildlife, U.S. Fish and Wildlife Service, NOAA, and the Washington State Department of Natural Resources. Options currently under consideration include:

- A ravine delta salt marsh restoration would consist of filling the existing intertidal riprap area adjacent to the West Harbor eelgrass planting site to restore gently sloping beach and salt marsh habitat that likely existed historically in this area. This project has a high probability of success, is on site and cost effective, and could concurrently address metals contamination at seep SP-02;

- The Schel-chelb Estuary wetland connection project would connect an existing 5-10 acre freshwater wetland that currently discharges to the Rich Passage (through a small outfall that periodically plugs) to the Schel-chelb Estuary. While the Schel-chelb is an existing mitigation project, the wetland connection is a new facet of that project that would provide saltwater connection to an adjacent fresh water marsh. This project offers the highest potential for overall habitat function development, has a high probability of success, and is cost effective;

- The Milwaukee Dock substrate restoration would consist of filling in a former navigation channel (the dock was removed more than 10 years ago) to a level consistent with adjacent eelgrass meadows. The Milwaukee Dock area is located off the eastern shore of the Wyckoff property in Puget Sound. This project has a moderate probability of success; and

- Eelgrass planting, such as at the Milwaukee Dock site or adjacent to the Wyckoff site, which has a moderate probability of success.

One of these alternatives will be selected, implemented, and monitored to ensure that adequate habitat mitigation has been performed for the habitat lost by the CDF construction.

East Harbor Operable Unit

Additional capping was placed in the locations where increased vertical concentrations were noted in deep cores. These locations will be sampled and evaluated in the next monitoring event and will be monitored closely in subsequent years. If continued monitoring events reveal that localized impacts are occurring within the cap versus general surface cap disturbances, then continued maintenance will be performed per the September 1994 ROD.

EPA will monitor the North Shoal and East Beach intertidal sediments in the upcoming fall 2002 monitoring event to assess contaminant concentrations in the top 10 centimeters. The East Beach intertidal sediments will also be monitored to determine if natural recovery, aided by source control and upland thermal remediation (if remedy is implemented), can achieve the cleanup goals established in the ROD. EPA will reassess current information after the start of upland thermal remediation to determine the condition of the beach and if additional studies and/or actions are necessary.

Soil and Groundwater Operable Units

The existing treatment plant and extraction system will have to be monitored closely and repair and maintenance activities should be continued to ensure its functionality and to maintain hydraulic control within the Former Process Area until a final groundwater and soil remedy is constructed (either full-scale thermal remediation or containment), currently estimated to be by the year 2005. Additionally, if the containment remedy is implemented, a more complete evaluation of the aquitard may need to be completed to ensure protection of the lower aquifer from NAPL intrusion. In any case, the lower aquifer will be monitored on a regular basis to ensure contaminant levels are not increasing.

X. PROTECTIVENESS STATEMENT(S)

The remedies for all four operable units are expected to be protective of human health and the environment. All immediate threats at the site have been addressed through containment of contaminated soil and groundwater with a pump-and-treat system and sheet pile wall, removal and consolidation of contaminated soil, removal and capping of sediments, and the installation of

fencing and warning/fish advisory signs. Long-term protectiveness of the remedial actions will be verified by additional monitoring and data collection.

West Harbor Operable Unit

The remedies have met, and with the implementation of additional actions to address the seeps in the area of the old landfill, are expected to meet the cleanup goals. Institutional controls are effective in controlling access to the upland areas and fish advisories are in place.

East Harbor Operable Unit

The remedies are expected to meet the cleanup goals. Exposure pathways that could result in unacceptable risks are being controlled. Institutional controls are preventing exposure to contaminated East Beach intertidal sediments and the ingestion of contaminated fish and shellfish.

Soil and Groundwater Operable Units

With the exception of the soil and upper aquifer groundwater within the Former Process Area, in which a final remedy will be designed and constructed once results from the steam injection pilot project have been evaluated, the remedies that are in place have met, or are expected to meet the cleanup goals. In the interim, exposure pathways that could result in unacceptable risks are being controlled. Site controls are preventing exposure to contaminated soil and groundwater. The final soil and groundwater remedy for the Former Process Area is expected to be in-place by 2005.

XI. NEXT REVIEW

The next five-year review for the Wyckoff/Eagle Harbor Superfund Site is required by September 26, 2007, five years from the date of this review.

SUPERFUND Fact Sheet

WYCKOFF/EAGLE HARBOR SUPERFUND SITE

Bainbridge Island, Washington

EPA U.S. ENVIRONMENTAL PROTECTION AGENCY February 2002

Wyckoff/Eagle Harbor Superfund Site Update

2001 was a big year for the Wyckoff/Eagle Harbor Superfund Site: sheet pile wall installation, cleanup of the former Log Storage/Peeler Area, habitat beach creation, harbor capping, and dealing with earthquake damage to the site's treatment system!

Now construction of the steam injection pilot study is in progress and a project checkup (called a five-year review) is about to begin. 2002 promises to be another year of accomplishments toward environmental cleanup. Read on to learn more about current and upcoming activities at Wyckoff.

EPA Project Manager Ken Marcy works hard building habitat beach.

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Test of On-Site Well Shows No Effect on Nearby Water Supplies

A water source will be needed for use in the boiler during steam injection. In early January EPA completed construction and testing of an on-site well. The water well is screened to a depth of 500 feet below ground surface. Preliminary pump test results show that the well can provide 200 gallons per minute (gpm) with no effect on nearby water supply systems. EPA monitored the Bill Point water supply system and the City's well located on Taylor Avenue during the pumping test. EPA worked closely with the Bill Point community and the City of Bainbridge Island throughout the water supply evaluation process. Chemistry samples were also collected during the test. Sampling data will be available in March.

As currently scheduled, the active steam injection period of the pilot project will be conducted between October 2002 and April 2003 (*i.e.*, EPA will withdraw water from the aquifer during this period of time to create steam for injection into the ground). Most of this period of active water withdrawal will occur during the wettest months of the year. Also, while the on-site water well has the capacity to pump at 200 gpm, EPA will require only an initial withdrawal of 150 gpm during the first several weeks of startup. After the initial startup period, water use will be reduced to an estimated 50-70 gpm of water during most of the steaming phase.

Steam Injection Plant Under Construction

The small-scale study of thermal treatment technology is now under construction, and could be operational by this fall. The purpose of this "pilot" study is to evaluate the performance of steam injection at the Wyckoff site. Steam will be pumped into the ground, and contaminants will be extracted. EPA expects to run the pilot system about a year. If the test is successful, EPA will move on to full-scale cleanup.

EPA has completed construction of a vapor cap over the study area. The vapor cap will prevent escape of vapors during system operation and will aid in soil cleanup. The vapor cap is about three feet thick. It includes a horizontal vapor collection layer, a geomembrane layer, and clean fill materials at the surface.

All 16 injection wells and seven extraction wells have been installed in the pilot area, as well as 75% of the thermal monitoring devices. Equipment for the steam injection plant will be delivered within the next several months. Equipment includes a boiler, a heat exchanger, tanks, pumps and pipes. Truck traffic for equipment delivery is expected to be light.

You may have noticed that a large building is being constructed on site. This building will be used to house the boiler and other operational equipment to minimize noise during the steam operation.

Former Log Storage/ Peeler Area Now Clean

EPA completed cleanup of the western portion of the site behind the newly created habitat beach, known as the former Log Storage/Peeler Area. About 40,000 cubic yards of soil (20,000 of which was contaminated) were removed last year as part of the construction of the habitat beach.

This year, EPA removed another 10,000 cubic yards of contaminated soil. All the contaminated soil was consolidated within the former process area for later cleanup, and excavated areas backfilled with clean soil.

Cleanup of the western portion of the site meets the State of Washington Department of Ecology's stringent residential cleanup standards.

Harbor Capping Complete

Construction of the Eagle Harbor cap is complete! The cap, which involved placing clean sediment over contaminated areas of the harbor floor, was completed in three stages. In 1993 and 1994, a 52-acre subtidal area was capped with about three feet of clean sediment. This area has been monitored closely since installation and is performing well.

In 2000 and 2001, EPA completed a 15-acre cap extending from the southern boundary of the earlier cap to the Wyckoff property, after containing creosote seepage with a sheetpile wall. This area of cap is also about three feet thick. In the last few months, more material was placed extending out several hundred feet from the Wyckoff property to form a gently sloping beach which connects a habitat beach to the west with existing intertidal areas to the east. A monitoring plan for capped areas is being revised, with monitoring of all capped areas resuming this year.

New Beach Provides Habitat

EPA recently created over two acres of new beach habitat on the western portion of the site. The beach makes up for habitat lost during sheet pile wall installation. Construction of the habitat area involved removing old bulkheads, and removing and contouring soil along the shoreline. The clean soil that was removed has been used to backfill behind the sheet pile wall. Contaminated material was removed and consolidated on the area of the site targeted for thermal cleanup. Once the soil was removed, a layer of "fish mix," or material with the grain size preferred by endangered species and smelt, was placed on the newly created beach. Creation of this site connects existing smelt habitat to the west and a new beach to the east, created as part of the capping project.

During the 2001/2002 construction season, additional beach material was placed over the rip rap at the top of the beach to improve overall habitat function. This winter, EPA planted a 20-foot habitat buffer extending from the top of the beach inland with a wide variety of native trees, shrubs, plants and grasses.

Come to a Community Meeting this Spring

EPA plans to host an informal community meeting sometime in Spring 2002. EPA Project Managers will provide an update on Wyckoff activities, discuss the Five-Year Review, and answer questions from community members. Watch for a postcard in the mail with scheduling details soon.

EPA's "Five-Year Review" Will Check Cleanup So Far

EPA conducts regular checkups, called five-year reviews, on certain Superfund sites. EPA looks at sites where cleanup is finished or where cleanup activity is still happening after five years. In both cases, EPA checks the site to make sure the cleanup continues to protect people and the environment.

The review at Wyckoff will be comprehensive. It will look at both the east and west portions of the harbor, where cleanup is essentially finished. It also will look at the groundwater and soil at the Wyckoff site, where cleanup activities are in progress. An EPA team with support from the Corps of Engineers will conduct the review, answer your questions, and share the results.

continued on page 4

continued from page 3

Early in 2002, the team will collect information about the site, including information on recent site activities and the cleanup. They will review the laws that apply and inspect the site. They will talk with the people who have been working at the site, as well as state, tribal and local officials. EPA also will seek information from some local residents. The team will check to see if cleanup activities continue to operate properly, and may take additional samples. In Spring 2002, EPA will host a community meeting where the public will have a chance to learn more about the review and provide informal input.

The team will use the information to decide whether or not the community and the environment are safe from contaminated material and how the community is affected by site cleanup activities. Once the team finishes the five-year review later this year, they will write a report. This report will include background on the site and cleanup activities, describe the review, explain the results, and include recommendations to fix any problems found during the review.

The final report, scheduled to be completed this fall, will be placed in the information repository at the Bainbridge Island Library. A summary will be mailed in a fact sheet to community members. After the review, the site managers will monitor the site to be sure any problems identified by the review team are fixed. As long as contaminated materials remain at the site, EPA will do a review every five years.

If you would like to discuss the five-year review with EPA, or have information that may be useful to reviewers, please call any of the contacts listed on page 5.

Site Background

EPA listed Wyckoff/Eagle Harbor as a Superfund site in 1987. The former Wyckoff wood treating facility, located at the mouth of Eagle Harbor on Bainbridge Island, operated from the very early 1900's to 1988. Soils at the facility, and groundwater beneath the facility, are severely contaminated.

Contaminants include creosote and other wood treatment compounds. About 1 million gallons of creosote product remain in the site's soil and groundwater. These contaminants pose a risk to public health and the environment.

A groundwater extraction and treatment system has been operated on site since 1990. However, contaminants were still moving into the marine environment until a sheet pile wall was installed in 2001. EPA will use thermal treatment technologies to clean up remaining soil and groundwater contamination.

In Eagle Harbor, bottom sediments were severely contaminated with chemicals from wood-treating and shipyard operations. A public health advisory recommends against eating fish and shellfish from the harbor. From 1993 to 2002, contaminated sediments in various locations were capped with clean material.

For More Information

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Toll-Free Telephone Number
1-800-424-4372

EPA Web Site:
www.epa.gov/r10earth/
click on "Index"
click on "W" for Wyckoff

Documents: The Administrative Record is a file that contains all information used by EPA to make decisions on the cleanup actions from the beginning of the site's history. The Administrative Record can be reviewed at the EPA Records Center, 7th Floor, 1200 Sixth Avenue, Seattle. Call 206/553-4494 to make an appointment. Select documents can be viewed at the Information Repository located at the Bainbridge Island Public Library, 1270 Madison Avenue North. If the library does not have the document you need, feel free to call Andrea Lindsay, EPA Community Involvement Coordinator, at (206) 553-1896.

Additional services can be made available to persons with disabilities by calling EPA toll-free at 1-800-424-4372.

SUPERFUND Fact Sheet

WYCKOFF/EAGLE HARBOR SUPERFUND SITE

Bainbridge Island, Washington

EPA U.S. ENVIRONMENTAL PROTECTION AGENCY August 2002

Wyckoff/Eagle Harbor Superfund Site Update

Answering Community Questions About Wyckoff/Eagle Harbor

In June, EPA hosted a community information meeting about the Wyckoff/Eagle Harbor Superfund Site. Besides updating the community on site activities, the meeting also gave project representatives a chance to hear directly from residents about their concerns. This fact sheet summarizes issues discussed at the meeting and raised by residents in recent conversations with EPA. It also previews upcoming steam activity at Wyckoff, and includes an editorial note from the Association of Bainbridge Communities. As always, if you have a question or issue that has not yet been addressed, feel free to contact anyone listed on the last page.

Wyckoff: Ramping Up for Steam

Watch for plenty of activity at Wyckoff this fall, as EPA reaches another major milestone toward site cleanup. The pilot steam injection plant ramps up this September, beginning the study of thermal treatment. Steam will be pumped into the ground and contaminants extracted. The pilot system will run for about a year. If the test is successful, EPA will make the decision to move on to full scale cleanup.

Boiler arrives at Wyckoff Site. Steaming begins in September.

In addition to testing the technology's effectiveness, the pilot also gives EPA (and the neighboring community) a chance to learn more about practical operation issues. For example, through the test, EPA will have a better handle on noise or other nuisances, and can take measures in advance of full scale operation. In the meantime, EPA has already taken significant measures to limit noise and other potential nuisances. A surface cap has been installed to collect any vapors from the site. Truck traffic is expected to be light.

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Answering Community Questions

1. Is the new beach open for recreation? What measures will be put in place to protect the beach?

Although contamination on the western portion of the site has been removed and consolidated in the former process area, the habitat beach, and all the beaches around the site, remain part of the Wyckoff/Eagle Harbor Superfund site. For now, these beaches are restricted to public access. EPA is considering posting additional signs to alert walkers and boaters to the fact that beaches around the site are restricted.

2. Is funding for the cleanup assured?

The steam injection pilot project is fully funded, with funding assured through September of 2003. Beyond 2003, EPA will depend on yearly Congressional appropriations for continued cleanup efforts.

3. What is the cost/benefit comparison of containment versus cleanup? Why is EPA not simply capping the site as was done at Gasworks Park?

The estimated cost of containment with a sheet pile wall, a new pump-and-treat system, and surface soil cap is about $28,500,000. This estimate includes capital costs plus 30 years of operation and maintenance (O&M). The estimated present-worth cost of full-scale thermal cleanup is about $46,000,000 (capital plus 10 years O&M). However, this cost difference does not reflect the fact that the pump-and-treat system would need to be operated and maintained, and occasionally replaced, in perpetuity, to preserve the integrity of the containment remedy. Over the long term, it is cost effective to proceed instead with contaminant removal and cleanup.

Another part of the equation is the potential costs and inherent risk of creosote product reaching the lower aquifer. An estimated one million gallons of creosote product still remain in the ground at the site. The clay "aquitard" layer that separates the contaminated aquifer from the lower aquifer is continuous. Its thickness generally ranges from 10 to 40 feet. However, it may be as thin as four feet in isolated areas, and in some locations, contain interbedded sand layers.

There is evidence that creosote product has penetrated the aquitard through a pathway within the sand lenses, but has not reached the lower aquifer. Based on field explorations, it also appears that there is a serious aquitard structural flaw located near the center of the site, possibly due to seismic activity.

Given the magnitude of contamination at Wyckoff and the questionable integrity of the underlying aquitard layer, the containment remedy would be used only if the steam injection pilot project fails to meet performance objectives (however, only until a better technology is available that will provide a more permanent solution).

4. What will be the configuration of the site's access roads, and what traffic safety measures will be put in place?

During the steam injection phase of the pilot study (6-8 months), up to four fuel deliveries by truck will be made to the site each week. The trucks will enter the site at Creosote Place NE, the site's main access road. Given the low truck traffic volume, EPA does not plan to reconfigure the site's main access road, and no additional traffic safety measures are planned. The exact schedule of truck deliveries is not known at this time.

Answering Community Questions, *continued*

5. Is the site's water well in the same aquifer as other wells? Will monitoring occur during the pilot to ensure that nearby wells are not impacted? What about water supply if cleanup goes full-scale?

No, the well that provides water for the cleanup is in a separate aquifer from those used by local wells, except for one city well. The South Eagle Harbor Well, located on Taylor Avenue, draws water from the same aquifer (Glaciomarine Aquifer). The well at the cleanup site draws water from a small portion of the aquifer, at around 500 feet. Pump tests of the well show very minimal or no effect on nearby water supply systems. EPA monitored the Bill Point water supply system and the South Eagle Harbor well during the pumping test. Contaminants associated with the Wyckoff site were not detected in either well.

EPA plans to conduct another round of water level and chemistry sampling of the Bill Point and South Eagle Harbor wells during the steam injection phase of the pilot operation, scheduled to begin in September 2002 and continuing through spring 2003. This sampling will provide more information about any effects on nearby wells from the steam injection operations.

The onsite water supply will be used during the pilot phase of the project. EPA will re-evaluate water supply options for the full-scale project.

6. Where does the water go after it is used for treatment?

After contaminated water is treated at the site's groundwater treatment plant, it will be discharged from an outfall to Puget Sound, in the same manner as it is discharged now. The discharge will meet the substantive requirements of the state's National Pollution Discharge Elimination System (NPDES).

7. Will there be intrusive lighting at night?

No, there will not be intrusive lighting at night. There will be some minimal lighting for site safety and security purposes.

8. How loud will the diesel boiler be? How are you containing sound? Why diesel? Will it smell or harm air quality or present a health issue? How will fumes be contained? Can energy be reclaimed or reused? How much fuel will be required?

The boiler has been delivered to the site and is housed in the "boiler building." It is difficult at this time, prior to boiler startup, to predict how loud the boiler operation will be. We expect the boiler building to minimize noise. EPA is also evaluating sound mitigation measures within the building, such as constructing enclosures around the louder pieces of mechanical equipment. If noise levels still exceed state regulations, EPA will take additional measures, such as increasing the level of insulation in the entire building.

Diesel is being used because it is an efficient fuel source and is cost-effective. The fuel selected for use at this site is a low-sulfur (less than 0.5%) diesel fuel. Air emissions will be monitored within the first two weeks of boiler operation to demonstrate compliance with air quality regulations. More monitoring will be conducted if results show a potential problem with emissions. Air near the treatment plant and within the pilot area will also be monitored on a regular basis.

Initial estimates of boiler emissions are far below both Federal and State reporting requirements. In fact, many public facilities on Bainbridge Island use similar boiler plants for heating. Until recently, oil-fired boilers similar to the one at the Wyckoff site heated Bainbridge Island High School.

Answering Community Questions, *continued*

The design of the steam injection system includes features to reduce overall energy requirements. For example, hot liquids extracted from the pilot area will be used to preheat boiler feed water. This reduces the amount of energy required to produce steam while decreasing the energy required to cool the extracted liquids before treatment.

During pilot steam injection operations, the boiler will require a maximum of 20,000 gallons of fuel per week. The pilot study is expected to use about 200,000 gallons of fuel. At this time, our rough estimate is that at most, 15,600 gallons of fuel will be needed per day for full-scale steam injection operation.

9. How long will the sheetpile wall last?

The sheet pile wall is designed to last for 30 years. If we proceed to full-scale thermal cleanup and we meet cleanup goals, then the sheet pile wall could be cut off at the mudline or removed and the shoreline restored to its natural condition.

10. Is the pilot wall as deep as the main perimeter wall?

Both the pilot area wall and the perimeter wall are seated at least 4 to 5 feet into the upper surface of the underlying aquitard layer. Since the aquitard is sloped from south to north, the pilot area wall does not extend as deep into the subsurface. The pilot area wall is about 15 to 45 feet deep, and the perimeter wall depths vary from 25 to 90 feet.

11. How long will it take to heat the site? How long will the site take to cool down? Will Eagle Harbor be heated by the steam project? Will habitat be affected by heat or by the wall's presence?

The pilot area likely will be heated within 2 to 4 weeks after steam injection begins. Modeling data indicate that cooling down after the full-scale project would take about two years.

If full-scale steam injection takes place, conservative modeling results show that marine life could be affected by heat within 10 meters of the wall. Data from the pilot project will help quantify possible impacts of heat on intertidal habitat loss, including eelgrass beds, and changes in the way habitat is used by marine life.

The presence of the sheetpile wall may affect sediment and water, which in turn affect intertidal habitat. Effects could include scour along the base of the wall, changes in grain size, and an increase in wave energy. Of the three possible effects, scour is the least likely to occur. In general, scour troughs along vertical walls have not been observed and attempts to measure have been inconclusive. Changes in sediment grain size due to sediment movement along the wall will be analyzed. Since the sheet pile wall presents a vertical face, it is expected to divert waves away from the shoreline, changing wave patterns at high and storm tides.

Effects on eelgrass are unknown but are not expected to be large. Baseline information on the extent and density of eelgrass was collected before the sheetpile wall was installed. If eelgrass meadows appear to be changing, more extensive monitoring will occur.

Answering Community Questions, *continued*

12. How deep will steam be injected? Will heat push contaminants down into or through the protective clay barrier (aquitard)?

Steam will be injected to the surface of the aquitard layer, which in the area of the pilot study is about 10 to 40 feet deep. Laboratory tests indicate that creosote product becomes less dense when heated. That means heavier oils that otherwise tend to sink in the aquifer would become lighter and float on the aquifer table. As a result, and through careful monitoring during operations, we do not anticipate that contaminants will be pushed into or through the aquitard.

13. How long will the pilot test last? If the pilot is successful, how soon will you move on to full scale treatment? How long would full scale treatment take?

The pilot project will last about one year, from September 2002 to September 2003. If the pilot project meets project objectives, we will most likely expand the project to site-wide, full-scale steam injection (dependent on funding). Based on the best scenario, designs of the full-scale project will be performed in 2004. Operations will begin sometime in late 2005. Active steaming will take place from 2005 to 2008, followed by about 5 years of continued contaminant extraction and treatment (2008-2013).

14. What provisions have been made for historic preservation at the site?

Prior to demolition of onsite structures in 1997, EPA produced a Historic American Engineer Record report. The report included a narrative and photo documentation, although the buildings demolished were deemed not "eligible for listing in the National Register." The documentation met the requirements of the Historic American Engineering Record standards. It also complied with EPA's Memorandum of Agreement with the Washington State Historic Preservation Officer and the Advisory Council on Historic Preservation.

Documentation was sent to the Prints and Photographs Division of the Library of Congress. A complete set of the original documentation was also provided to the Bainbridge Island Historical Society for use in their museum. An archeological assessment was also conducted in consultation with the Suquamish Tribe.

15. Is EPA still planning a potential buffer around the site?

EPA is drafting land use controls that will require any future land owner of the Wyckoff site to ensure that intertidal habitat functions are maintained and protected. A vegetated habitat buffer is an effective way to protect the intertidal area that has been remediated and enhanced as part of the Eagle Harbor cleanup. The concept of a vegetated buffer was also supported, in large part, by citizens of Bainbridge Island in response to a request for comment issued by EPA in March of 2001. Any measures that are taken to protect the intertidal habitat around the Wyckoff site, including a vegetated buffer, will be undertaken and maintained by the future owner of the site.

16. Can the stream at the west end of the site be put back on the surface?

There are no plans to put the stream back on the surface of the site.

Answering Community Questions, *continued*

17. What are the status of and future plans for the eelgrass beds in the Harbor (planted by the Department of Transportation as a mitigation requirement)?

The 0.6 acre eelgrass bed planted by the Washington State Department of Transportation in September of 1998, has been monitored regularly since its creation. Since the year 2000, no eelgrass has been observed in or near the transplant site. The failure of the eelgrass bed has been due in large part to excessive macroalgae coverage, which has prevented light from reaching the newly planted eelgrass.

In June 2001, WSDOT issued a contingent habitat mitigation screening analysis, looking at possible habitat projects that could be undertaken in place of the failed eelgrass bed. EPA has reviewed this document and provided comments to the state. The state will provide a more specific proposal by the end of the summer.

18. How is the sediment cap performing?

Monitoring of the 52-acre cap placed in 1993 has indicated that the cap is stable (remains in place) and is effectively isolating contaminants. The last monitoring was conducted in 1999, before the sheetpile wall was installed and effectively contained contamination on site. Now that cap construction is complete, monitoring of all capped areas will start up again later this summer.

19. Are there warning signs about the no-anchor zone in the harbor? Who should we notify if we see a boat anchored over the cap? How will enforcement of the no-anchor zone occur?

When the no-anchor zone was created by the U.S. Coast Guard in 1998, the perimeter of the area was effectively marked with warning signs on buoys. The buoy signs are maintained by the Coast Guard. EPA is considering posting signs on the top of the shoreline around the Wyckoff site noting the presence and location of the no-anchor zone.

The Coast Guard should be contacted if vessels are observed anchored in the restricted navigation, or no-anchor, area. The Coast Guard, with the help of local authorities, will continue to maintain and enforce the no-anchor area.

Five Year Report Available for Review Soon

EPA is conducting a "5-Year Review" of the Wyckoff/Eagle Harbor site. This review is a checkup to make sure the cleanup continues to protect people and environment. In response to community requests, EPA will make the draft 5-Year Review Report available for informal public review. Watch for notification soon to find out where to get a draft report.

Site Background

EPA listed Wyckoff/Eagle Harbor as a Superfund site in 1987. The former Wyckoff wood treating facility, located at the mouth of Eagle Harbor on Bainbridge Island, operated from the very early 1900's to 1988. Soils at the facility, and groundwater beneath the facility, are severely contaminated. Contaminants include creosote and other wood treatment compounds. About 1 million gallons of creosote product remain in the site's soil and groundwater. These contaminants pose a risk to public health and the environment.

A groundwater extraction and treatment system has been operated on site since 1990. However, contaminants were still moving into the marine environment until a sheet pile wall was installed in 2001. EPA is testing thermal treatment technologies to clean up remaining soil and groundwater contamination.

In Eagle Harbor, bottom sediments were severely contaminated with chemicals from wood-treating and shipyard operations. A public health advisory recommends against eating fish and shellfish from the harbor. From 1993 to 2002, contaminated sediments in various locations were capped with clean material.

A Note From Association of Bainbridge Communities

contributed by Dave Davison, Co-Chair, Association of Bainbridge Communities

Thermal Treatment is Least Expensive Cleanup Option in Long Run

ABC would like to respond to recent questions about a cost benefit analysis, comparing the containment alternative to the thermal cleanup alternative. Containing the site would essentially leave the contaminants in the ground. Thermal cleanup, if it works as effectively as hoped for, will remove most all of the creosote, now estimated at one million gallons.

EPA's Hanh Gold gives ABC members a site tour.

The cost for containing the contaminants at the site with a layer of impervious asphalt or plastic membrane and cover, and for building and operating a "pump and treat" system that would hold the site at pressure balance, is estimated by EPA at $28.5 million. This continuous pump and treat process would remove perhaps a third of the creosote over time. This cost estimate is projected out for 30 years.

By comparison, the projected cost of cleanup by means of thermal treatment (steam cleaning) is about $46 million. After 10 years of cleanup, however, it is expected that the site would be clean and would no longer pose a threat to human health or the environment. There would be only nominal continuing costs related to occasional monitoring of the site. The containment wall is included in both proposals and is already in place.

Capping the site and operating a "maintenance" pump and treat system appears to be the least expensive option in terms of dollars spent by EPA during the time frame given, but this assumption is misleading.

As EPA points out, this cost does not include the costs of continuing to operate a pump and treat system to adequately contain the site. Assuming that these costs would remain the same (and the life of the systems about the same), the cost for each 30 years would be about $28.5 million.

Leaving the creosote product in place (containment option) with reduction by one third after 30-50 years, is also "a disaster waiting to happen." Eventually the creosote would contaminate the fresh water aquifers below the aquitard and recontaminate the marine environment. The environmental cost of that eventuality is huge and unacceptable. And there is the economic and social cost of having a permanent dead zone at Eagle Harbor's entrance.

This is an easy cost benefit analysis. Spend a little more now and save a lot in the long term, and reap the rewards of a clean site relatively soon. Refuse to spend more on thermal treatment now and be prepared to spend a lot more later, and probably have a lot bigger problem later. Questions or comments? E-mail biabc2000@yahoo.com.

For More Information

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Toll-Free Telephone Number
1-800-424-4372

EPA Web Site:
www.epa.gov/r10earth/
click on "Index"
click on "W" for Wyckoff

Documents: The Administrative Record is a file that contains all information used by EPA to make decisions on the cleanup actions from the beginning of the site's history. The Administrative Record can be reviewed at the EPA Records Center, 7th Floor, 1200 Sixth Avenue, Seattle. Call 206/553-4494 to make an appointment. Select documents can be viewed at the Information Repository located at the Bainbridge Island Public Library, 1270 Madison Avenue North. If the library does not have the document you need, feel free to call Andrea Lindsay, EPA Community Involvement Coordinator, at (206) 553-1896.

Additional services can be made available to persons with disabilities by calling EPA toll-free at 1-800-424-4372.

Text of display ad run in mid-March 2002

Wyckoff/Eagle Harbor Superfund Site
EPA Review Will Check Cleanup So Far
Draft Report Out for Public Review

The U.S. Environmental Protection Agency is about to begin a "five-year review" of the Wyckoff/Eagle Harbor Superfund Site on Bainbridge Island. The site is severely contaminated with wood treatment compounds, and cleanup is in progress. EPA, with support from the Corps of Engineers, will do the review to make sure that the cleanup completed so far is working and that people and the environment are protected as work continues.

Reviewers will look at the completed work in the harbor and intertidal beaches, and at the former Wyckoff property where groundwater and soil are still contaminated. The team will collect site information, review laws, consult with officials and community members, and possibly take samples. The final report and recommendations will be available this fall.

A community meeting to provide a status of site cleanup and discuss the five-year review process and public participation will be scheduled later this spring, but your suggestions are welcome now. Information that may be useful to EPA includes comments on what you believe should be included in the review, your impressions of the cleanup work, how the cleanup has affected you, local developments that might affect site work, environmental concerns, and so on. To discuss the review or to be added to the mailing list, call Andrea Lindsay, 206/553-1896. To learn more about Wyckoff, visit www.epa.gov/r10earth/ (click on Index, click on W for Wyckoff).

Wyckoff/Eagle Harbor Superfund Site
Five-Year Review, March 2002
Community Interview Questions for Informal Discussion

Background:

- EPA is required by law to do a site checkup, called a five year review.
- EPA is checking to make sure that people and the environment are safe from contaminated material and to learn more about how the community is affected by site cleanup work.
- This review will include the East and West Harbor and the Wyckoff site.
- EPA is collecting information about the site from many places: reviewing laws and data, talking with government and Tribal officials, and talking with community members
- EPA will prepare an official report by September.
- The report will include recommendations to fix any problems found during the review.

Answers to the following questions will help EPA prepare the report and make any recommendations for things that need to be addressed. We would like to have an informal discussion with a variety of community members to find out....

- Are there community issues that we haven't addressed yet?
- Are there questions we still need to answer for the community?
- Are there problems which need fixing?

1. What is your overall impression of the project? Are you satisfied with the cleanup thus far?

2. Do you think progress is being made toward cleanup?

3. What effects have site operations had on you and your community? Have there been any nuisances for you?

4. Are you aware of any incidents at the site such as vandalism or trespassing?

5. Perhaps in a decade this site will be cleaned up. Already substantial progress has been made. We have a harbor capped with clean sediments, a new beach, the contaminants are now contained, and part of the land is clean. What do these changes mean for you and your community?

6. Have you been well informed by EPA on site progress? Have you been surprised by any site activities? Should EPA do anything differently to inform and involve the public about site work?

7. Have you contacted any EPA employees regarding Wyckoff? Who? Were they responsive? Did they address your concerns? Would you contact them again?

8. Do you have any suggestions, comments, or recommendations regarding the site's management or

operation?

7. Do you have any other suggestions for EPA as we move forward with the 5-year review?

Wyckoff/Eagle Harbor Superfund Site
Five-Year Review, May 2002
City of Bainbridge Island
Interview Questions for Discussion

Background:

- EPA is required by law to do a site checkup, called a five year review.
- EPA is checking to make sure that people and the environment are safe from contaminated material and to learn more about how the City of Bainbridge Island is affected by site cleanup work.
- This review will include the harbor and the Wyckoff site.
- EPA is collecting information about the site from many places: reviewing laws and data, talking with state and local government, community members, and Tribal officials.
- EPA will prepare an official report by September.
- The report will include recommendations to fix any problems found during the review.

Answers to the following questions will help EPA prepare the report and make any recommendations for things that need to be addressed. We would like to have an informal discussion with the City to find out....

- What are your impressions of the cleanup?
- What are your environmental concerns?
- Are there City issues that we haven't addressed yet?
- How has the cleanup affect the City?
- Are there remaining questions we still need to answer for the City regarding the cleanup?
- Are there problems which need fixing?

1. What is your overall impression of the project? Are you satisfied with the cleanup thus far?

2. Do you think progress is being made toward cleanup?

3. What effects have site operations had on the City? Have there been any nuisances for you?

4. Perhaps in a decade this site will be cleaned up. Already substantial progress has been made. We have a harbor capped with clean sediments, a new beach, the contaminants are now contained, and part of the land is clean. What do these changes mean for the City and its community?

5. Have you been well informed by EPA on site progress? Have you been surprised by any site activities? Should EPA do anything differently to inform and involve the City about site work?

6. Do you have any suggestions, comments, or recommendations regarding the site's management or

operation?

7. Do you have any other suggestions for EPA as we move forward with the 5-year review?

Wyckoff/Eagle Harbor Superfund Site
Five-Year Review, May 2002
Suquamish Tribe Interview Questions for Discussion

Background:

- EPA is required by law to do a site checkup, called a five year review.
- EPA is checking to make sure that people and the environment are safe from contaminated material and to learn more about how the Tribe is affected by site cleanup work.
- This review will include the harbor and the Wyckoff site.
- EPA is collecting information about the site from many places: reviewing laws and data, talking with state and local government, community members, and Tribal officials.
- EPA will prepare an official report by September.
- The report will include recommendations to fix any problems found during the review.

Answers to the following questions will help EPA prepare the report and make any recommendations for things that need to be addressed. We would like to have an informal discussion with the Suquamish Tribe to find out....

- What are your impressions of the cleanup?
- What are your environmental concerns?
- Are there Tribal issues that we haven't addressed yet?
- Are there remaining questions we still need to answer for the Tribe regarding the cleanup?
- Are there problems which need fixing?

1. What is your overall impression of the project? Are you satisfied with the cleanup thus far?

2. Do you think progress is being made toward cleanup?

3. What effects have site operations had on the Tribe? Have there been any nuisances for you?

4. Perhaps in a decade this site will be cleaned up. Already substantial progress has been made. We have a harbor capped with clean sediments, a new beach, the contaminants are now contained, and part of the land is clean. What do these changes mean for the Tribe?

5. Have you been well informed by EPA on site progress? Have you been surprised by any site activities? Should EPA do anything differently to inform and involve the Tribe about site work?

6. Do you have any suggestions, comments, or recommendations regarding the site's management or operation?

7. Do you have any other suggestions for EPA as we move forward with the 5-year review?

Wyckoff/Eagle Harbor Superfund Site
Five-Year Review, May 2002
Interview Questions for Discussion

Background:

- EPA is required by law to do a site checkup, called a five year review.
- EPA is checking to make sure that people and the environment are safe from contaminated material and to learn more about how the Natural Resource Agencies are affected by site cleanup work.
- This review will include the East and West Harbor and the Wyckoff site.
- EPA is collecting information about the site from many places: reviewing laws and data, talking with state and local government, community members, Tribal officials, and Natural Resource Trustees (NRTs).
- EPA will prepare an official report by September.
- The report will include recommendations to fix any problems found during the review.

Answers to the following questions will help EPA prepare the report and make any recommendations for things that need to be addressed. We would like to have an informal discussion with the Natural Resource Trustees to find out....

- What are your impressions of the cleanup?
- What are your environmental concerns?
- Are there NRT issues that we haven't addressed yet?
- Are there remaining questions we still need to answer for the NRTs regarding the cleanup?
- Are there problems which need fixing?

1. What is your overall impression of the project? Are you satisfied with the cleanup thus far?

2. Do you think progress is being made toward cleanup?

3. What effects have site operations had on the NRTs? Have there been any nuisances for you?

4. Perhaps in a decade this site will be cleaned up. Already substantial progress has been made. We have a harbor capped with clean sediments, a new beach, the contaminants are now contained, and part of the land is clean. What do these changes mean for the NRTs?

5. Have you been well informed by EPA on site progress? Have you been surprised by any site activities? Should EPA do anything differently to inform and involve the NRTs about site work?

6. Do you have any suggestions, comments, or recommendations regarding the site's management or operation?

7. Do you have any other suggestions for EPA as we move forward with the 5-year review?

City of Bainbridge Island

On June 3, 2002, Libby Hudson, Senior Planner at the City of Bainbridge Island, Lhudson@ci.bainbridge-isl.wa.us; (206) 780-3767, was interviewed by telephone. The interview questions are included in Appendix D. Generally, the city felt that the cleanup is progressing well, communication and information sharing with the City has been good, and they are very supportive of the selection of steam injection as the cleanup remedy for the site. Since the City is a potential purchaser of the site (see discussion regarding Reasonably Anticipated Future Land Uses, above), they have the following questions and concerns:

- The East Harbor sediment cap is in the direct route of the Washington State ferries lane. How would ongoing heavy boat and ferry traffic affect the long-term integrity of the sediment cap?

- EPA, the State of Washington State Department of Natural Resources (DNR), and the U.S. Coast Guard established a No Anchor Zone prohibiting anchorage of boats on the East Harbor sediment cap. This prohibition is over a very large area and the Harbor Commission has received numerous complaints from boat owners. Can the size of this area be reduced to just the area where the cap exists? Also, how is this No Anchor restriction communicated to boat owners; does it appear on both old and new charts?

- The State of Washington Department of Transportation never obtained a shoreline permit from the City for construction of the West Harbor nearshore confined disposal facility (CDF), which is now a parking lot and storage area. The City is concerned that there is no visual buffering between the CDF and the shoreline. How does EPA intend to address this issue?

- The uncertainty of available funding for future cleanup actions, particularly for the potential full-scale thermal remediation project, is a concern for the City.

- Because we have so much community, Congressional, and local interest in the site and the steam injection pilot project, the City suggested that EPA put up a small billboard or bulletin board outside the gates at the site to inform visitors of the cleanup activities. Some ideas include a brief summary, with accompanying graphics, describing the steam injection process and what it is. Information such as the duration of steam injection operation would also be useful.

- Vertical migration of contaminants through the underlying aquitard is a major concern for the City, especially from the standpoint of a potential purchaser.

- How would institutional controls be applied to the site?

- What is the official EPA position and status of the vegetative buffer around the site?

The City has not heard from EPA regarding this matter for almost a year.

- What is the delisting process that EPA undergoes for the clean portions of the site?

- EPA should produce regular fact sheets (e.g., every January, May, and September) so the community can expect them on a more regular basis. The City would also appreciate being given a heads-up of when a fact sheet will be published.

- A report on the functionality of the new habitat beach would be very helpful. For example, the City is interested to know whether we have lost any beach material during the last several months; what kind of animal and marine species are occupying the site; is the habitat beach meeting design and resource recovery expectations; what is the survivability/mortality rate of the plants?

- Please provide a status of the pilot study.

- What is the status of the sediment cap? Has marine life been revived on the cap and the cap recolonized? If so, by what critters? What happened to the geoducks, did they get buried during the capping project?

The Suquamish Tribe

On June 25, 2002, EPA met with Rich Brooks, Biologist, rbrooks@suquamish.nsn.us; (360) 394-5250, and Charlie Sigo, Tribal Council Member, of the Suquamish Tribe at the Wyckoff/Eagle Harbor Superfund site for a site walk and to discuss their impression of the cleanup and any concerns they may have. The Suquamish Tribe's overall impression of cleanup activities at the Wyckoff/Eagle Harbor site is very positive. The Tribe supports using thermal treatment remediation at the Wyckoff site and other remedial actions that have been conducted at the operable units. The Tribe recognizes the efforts of the Remedial Project Managers in developing a positive government working relationship and for implementing actions that support the protection and enhancement of Tribal trust and cultural resources. The Tribe also appreciates the cultural resources assessment work conducted at the site and the Memorandum of Understanding between the Tribe and EPA for the inadvertent discovery of cultural resources.

The Tribe is interested in protecting Tribal trust resources, Treaty-reserved rights, and cultural resources that are of religious or cultural importance to the Tribe. Environmental concerns the Tribe has at the site include:

- The vertical and horizontal extent of PAH contamination within and adjacent to the "East Beach" area.

- Contaminant levels in fishery resources above acceptable human health levels for subsistence users. A Suquamish Tribe fish consumption survey was completed in August 2000 and show Tribal consumption levels higher than the Reasonable Maximum Exposure (RME) exposure assumptions used in the human health risk assessments.

- Contaminant levels in geoduck tissues above human health risk levels. Commercial geoduck tracts #07700 and #07650 are to the east of the Wyckoff/Eagle Harbor Superfund site. A 1997 Washington State Department of Health document, "Assessment of Geoduck Chemical Contamination Adjacent to Eagle Harbor", indicated PAH contamination concerns and recommended geoduck tissue and sediment samples be collected from the proposed harvest area. Geoduck resources within these commercial tracts are important to the Suquamish Tribe.

- Biological effects to marine species exposed to PAH sediment concentrations above 2,000 ppb (dry weight).

- The protection of nearshore habitat and the sediment cap from future uses that may degrade the sediment cap, nearshore habitat, or sediment and water quality.

- Establishing and maintaining an adequate native vegetative buffer width within the nearshore area of the site.

- Thermal effects to aquatic biota outside of the sheet pile wall as a result of thermal technology operations at the site.

- EPA Region 10 not receiving adequate funding for future Wyckoff/Eagle Harbor cleanup actions, including but not limited to, the potential full-scale thermal remediation project, long-term monitoring activities, and East Harbor remedial actions.

National Oceanic and Atmospheric Administration (NOAA)

Email transmittal from: Robert Clark
NOAA Restoration Center
robert.clark@noaa.gov
(206) 526-4338
August 9, 2002

While it would be nice to have the upland pilot and cleanup moving a little faster, Ken Marcy's clean up of the aquatic lands have been very good. He has incorporated NOAA's input into his designs and kept us informed of changes. His design for the capping and intertidal restoration was environmentally sensitive and exceeded minimum compensation to allow for ESA recovery through EPA's commitment to the "conservation" clause in Sec. 7.a.l of the Endangered Species Act. From NOAA Restoration Center's point of view and a decade of experience of working with EPA on Superfund cleanups, I have no criticisms of the progress or of the ultimate benefits to our trustee resources. Just keep pushing EPA HQs to keep the momentum (and funding) moving forward.

Washington State Department of Natural Resources (DNR)

Email transmittal from: Chris Hanlon-Meyer
Natural Resource Section Administrator
DNR Aquatic Resources Division
chris.hanlon-meyer@wadnr.gov
(360) 902-1676
August 20, 2002

Here are some thoughts that staff within the Washington Department of Natural Resources Aquatic Resources Division (DNR) have in response to your Wyckoff/Eagle Harbor Superfund Site Five-Year Review, May 2002, Interview Questions for Discussion. While some of our comments may not directly address the questions that you presented, we believe that we identified some notable issues. We appreciate the attention that EPA is giving to remedial action progress at superfund sites. Our hope is that our comments will help EPA during the final implementation of the cleanup.

1. What is your overall impression of the project? Are you satisfied with the cleanup thus far?

Regarding the pilings that were cut off and said to be maintained below the mudline; all or most of them appear to be exposed.

The contaminated sediment cap was designed as a test-cap. When will EPA decide on the final remedy?

2. Do you think progress is being made toward cleanup?

No comment

3. What effects have site operations had on the NRTs? Have there been any nuisances for you?

No comment

4. Perhaps in a decade this site will be cleaned up. Already substantial progress has been made. We have a harbor capped with clean sediments, a new beach, the contaminants are now contained, and part of the land is clean. What do these changes mean for the NRTs?

Regarding ongoing site management and operations, how will "no anchor" provisions be coordinated and enforced.

The contingency mitigation needed as a result of the eel grass mitigation failure should be implemented near term. Additionally, because the original mitigation failed, greater mitigation should be required now than was originally required.

EPA has communicated well and openly accepted input, even at late stages (e.g. steam sparging comments).

The contaminated sediment cap is designed to isolate contaminants left in place (not removed or cleaned up). As long as the cap and contaminated sediments are left in place, state owned aquatic land is encumbered, and there is a risk of contaminant release (cap failure). The presumption of question #4 is that capping contaminated sediments is "cleanup." DNR considers contaminated sediment caps as not a full cleanup, but a temporary measure to reduce risk to human health and the environment.

5. Have you been well informed by EPA on site progress? Have you been surprised by any site activities? Should EPA do anything differently to inform and involve the NRTs about site work?

Yes, there has been good communication and regular status reports. DNR was surprised that the in-water sediment migration was not as controlled as expected. On-beach machining operations and visible in-water sediment translocation was observed and visitors footwear was required to be decontaminated, yet there were no best management practices employed to control contaminant migration (via surface runoff, etc.)

6. Do you have any suggestions, comments, or recommendations regarding the sites management or operation?

No Comment

7. Do you have any other suggestions for EPA as we move forward with the 5-year review?

We suggest that EPA provide a monitoring report, completion report, or status report to the NRTs prior to the next five-year review so that information could be used in their review.

DNR is interested in getting copies of any monitoring reports, completion reports or status reports as they are produced. Please change the current DNR trustee contact information to the following: Chris Hanlon-Meyer, Department of Natural Resources, Aquatic Resources Division, 1111 Washington St. SE, P.O. Box 47027, Olympia, WA, 98504-7027

Thank you for your patience in giving us the opportunity to give our input. We look forward to the continued success of this cleanup.

Washington State Department of Fish and Wildlife (WDFW)

Email transmittal from: Randy Carman
WDFW Habitat Program
carmarec@dfw.wa.gov
(360) 902-2415
August 20, 2002

Here are my brief comments on cleanup efforts at Wyckoff/Eagle in response to your request.

Overall, the cleanup effort appears to be progressing quite well and WDFW appreciates the efforts EPA has made to coordinate and communicate details of the ongoing activities at the site with natural resource agency representatives. Given the complexity of the contamination problems at the site, EPA has done an admirable job of developing an integrated strategy (e.g., capping and thermal remediation) that should provide long term benefits to fish and wildlife resources that utilize the site.

WDFW supports using thermal remediation as the most feasible alternative for extracting the large amount of NAPL that currently remains at the site. We are concerned, however, that EPA may not continue to receive adequate funding to fully implement the cleanup action at the site. Given the tremendous efforts to date at the site, including the large financial expenditures, and the high potential for a successful cleanup, it would be quite disappointing to WDFW if funding problems precluded completion of this important project.

Although communication from EPA regarding site activities has been quite good, it has been nearly a year since our last meeting to review progress at the site. So, for example, we have not been informed of how the caps have been performing, or how the "habitat" beach may have changed since its construction (erosion, accretion, etc.). In addition, we provided comments on the merits of developing and maintaining a vegetated shoreline buffer at the site, but have not heard what EPA has planned for the nearshore upland areas of the site in regard to this issue.

Finally, our greatest interest is ensuring that, once the site is remediated, adequate protections are implemented to prevent future degradation of nearshore habitat and sediment caps at the site. The long-term integrity of nearhsore habitats at the site (both aquatic and riparian) is necessary to provide high quality functions for fish and wildlife that frequent the area. To this end, the Natural Resource Trustees developed a set of restoration goals (finalized Oct. 12, 2001) to address conditions at the site that largely influence natural resource functions. These restoration goals provide the foundation for a long term strategy that should be developed for the site to ensure the persistence of high quality habitat for natural resources at the site.

Thank you for the opportunity to provide comments on the continuing progress at the Wyckoff/Eagle Harbor Superfund site.

Notes from Community Interviews

(Please note: this document is based hand-written notations and is not intended to be a formal transcript of the interviews.)

Jessie Hey, Resident across the water from the site 4/8/02

She sees it from a distance; Looks great visually.
Concerned that she's not familiar with toxic elements — how does it affect my beach? How clean is the beach? When can we dig clams and catch crabs again? As a family they used to do that. Ignorance was bliss then. 40 years here.

Can't say if progress is being made until they can dig clams again. The site looks too tidy, now-- the cleanup is too neat. The chaos of the working site is gone now; people used to work there, it was a productive part of our community.

No longer bothered by lights. Never considered it a real problem because she knows it would pass. Should already be close to being cleaned up. 10 years seems long.

Concerns: Future noise. Wind direction is an issue for noise. SE winds blow her way. How will cleanup happen (described steam pilot).

It's not a working site. What's the plan for the future? In terms of the new beach, people might tend to mess up the beach - need to consider that - making garbage cans available. Keep it clean.

No problem staying informed. Knows the job has to be done. Has contacted us & EPA has been responsive. Not a complainer - likes to be constructive. Appreciate the cleanup. Miss the smokestack and the working site - home grown employment.

Would like to see a day storage; places people could make money that are environmentally sensitive - not just a park. Would like city to get some of the property. Maybe a passenger only ferry.

Will call in September if it's noisy when the study begins.

Charles Schmid, Community Activist and ABC Member 4/19/02

- Going well, but slower than expected
- Fairly satisfied. Except disappointed that EPA is not using waste water treatment effluent.
- Noted lack of formal response to public input on buffer zone.
- Disappointed to see plumes still coming up outside the wall.
- Pleased with the beach.
- Citizens and EPA share optimism about new plans.

- Shocked to learn how much contamination–1 million gallons!
- Looking toward restoration of the site to a cleaner site for humans, plants, and animals.
- Supports Japanese Memorial. The restoration is not just for Japanese Americans but for the Island and its environment.

-Feels well informed. Especially through Technical Assistance Grant (TAG) meetings and site tours. Appreciated Travis and Hanh taking the group around the site.
-Disappointed on the effluent decision. Other than that, feels EPA is responsive and inclusive.
-Regarding interviews, multiple choice would be better. It lets you know what people don't know. Random Survey. Otherwise just "Good guys, Bad guys." Compile comments and don't know how you've done.
-Aware that nuisances may be an issue: noise, traffic, lights.
-Encouraged EPA to share compiled results of this effort with ABC.
-West Harbor - eelgrass navigation. Would like to see a report on its success.
-Was other mitigation successful? Ferry Terminal maintenance. Asphalt area. What's happened with that? Just being used as parking lot. Confused what was actually done.
-What are the effects of the sheet pile on the plants/salmon/habitat right outside the wall? Because it is not a beach but a sheer face.

Susan Johnson, Adjacent Resident 4/15/02

New beach is great, huge!

Wondering about cost benefit of steam. Lots of money to sink into ground for questionable long term benefit. She says she is speaking for about 15 people/taxpayers, who are also wondering.

Many people say, "gasworks is now a park and it was just capped." That was enough. Why do we need to go to the level of clean we're trying to achieve? Cap could be enough here too, especially if it's a park?

For the park - less cleanup should be required than residential standards! She supports the park.

Nuisances - endured the pounding. Knew it would end. But the steam cleaning is a different story–it could last for a decade or more (which seems forever). What will be the sound impact? This is a whole new operation, and we've no idea of impact. Cautious about what this means. Very anxious.

Aggravations at night - noise. Occasionally "refrigerator noise" when the pumps switch, a hum.

Corps and EPA incredibly responsive. So great.

Lights during concrete pouring for shed were on until after midnight. Was not notified in advance.

What things are day/season/forever things? Needs heads up and to know in advance the length of disturbance. Starting to feel irritable; it's been going on for 5 years already.

Water supply issues are acute because it is an island. Was the bill point well tested? Unclear if their baseline has been established. How much ongoing monitoring will happen during pilot? How does the 1 year test relate to the 10 year reality? More testing, reassurance, and communication is better.

Graffiti and vandalism - called 911 one night and it took them 1.5 hours to get there! Called 3 times. Smashing glass on site. Wish historical buildings were out of there. There are 50 feral cats & lots of parties.

EPA has been very responsive. Trimmed growth in the way of the views, good. Coordinated with the Trustee. Communication among all partners - EPA/Corps/Trustee - just excellent! Kudos on the communication and timely responses.

Funding issue. Superfund costs---are we on the right trajectory given the current funding climate?

People are aware of what's going on. Site visit was much appreciated and very helpful.
All "Asks have been answered".

Remaining questions about the final disposition of the land.

Sean Oldkin, Bremerton Kitsap County Health District, Poulsbo Office 04/02

- Need to be clear about what are the pathways to endanger people's health.

- Posting & maintaining those signs - the health district does this. Is the content of the signs complete and accurate? Currently very general. EPA input welcome on the sign content. Also are locations of signs adequate?

- State Dept of Health. Could look into whether shell fish tissue monitoring is in order to revisit health advisory. Still likely potential for exposure. Could assist w/signs if any changes are warranted.

- Are Asian Pacific Islander harvesters active there?

WYCKOFF COMMUNITY INFORMATION MEETING
Questions and Issues
JUNE 13, 2002

Can we use the beach now for recreation?
Are you going to water the new plantings?
Is the site well in same aquifer as other wells?
Where does the water go after it's used for treatment?
How will you contain sound on the emergency generator?
Lights?
Will trucks run when school busses are running?
How loud will diesel boiler be?
Smell of diesel? Air quality?
How long will the wall last? Ultimate disposition?
How long it take to heat the site?
Are there other sites using this technology?
Is pilot wall as deep as other wall?
Will Eagle Harbor be heated up by steam project? Habitat affected?
How deep will we inject?
Will heat push contaminants down into/thru aquitard?
Takes 2 years for soil to cool down?
If successful how soon will you move to full scale?
Diesel fumes from boiler to be contained?
Full scale would be 3x the fuel?
What does boiler fuel exhaust compare to?
How much fuel to be used? - compared to ferry consumption? Emissions?
Health issues? Can energy be reclaimed? Reused?
Can stream be put back on the surface?
Offer a community review opportunity of the draft 5-Year Review report.
Extraordinary effort so far - come so far - beach is reclaiming nature quickly. An 80 year problem doesn't bring a 3 day solution. Let's be patient.
Technology is innovative and exciting. This is an example of government doing something right. Laudable.
EPA has decommissioned road. Thanks for sensitivity.
Dangerous intersection - so some disagree that road decommissioning is a good idea. Would like to see improvement to safety at that intersection. Can use the road for public beach access?
Site looks good. Tremendous change in appearance. Beach is beautiful.

Marine algae monitoring - what are the results?
Riprap on the whole length of beach is not proper. (Riprap is now buried; issue is resolved.)
ABC pleased with progress.
Planted eelgrass? Where is the eel grass at low tide? Are you working with UW on eelgrass? Need to study wall and eelgrass interaction. DOT eelgrass West Harbor has failed? Provide an update. Let's

ask for another mitigation! ABC wants to be involved in mitigation decisions.
How will wall affect eelgrass beds?
Setting the riparian buffer - asked citizens for input and never heard back. There were many comments. Why not in a report?
Marine Traffic - are there warning signs about no-anchor zone? Who should we notify if we see a boat anchored over the cap? How thick is the cap? How enforcement of no-anchor zone occur?
ABC is supportive of EPA and Corp progress. Remember only 3 years ago the plan was for a cap. One million gallons is a time bomb. Community should be supportive of cleanup. The real objective is cleanup. ABC asked for changes in design features, regarding noise, air pollution, lighting, water use issues. ABC has a major issue with EPA on water source - Should have used effluent instead of using freshwater - makes no sense. EPA did not include ABC early enough on the issue. Fisheries' concerns made it difficult. ABC also pushed for propane - cleaner. Cost issues probably defeated that solution. Even complying with standards, there will be air pollution. EPA has been open and listened to us. Wish they implemented more of our ideas.
Historic preservation - could have used old buildings as office space; buildings on site from 1880s should be preserved.
EPA is doing so much good. Some people focus too much on criticism of petty things.
Creosote piles from main dock are seeping creosote - why didn't you pull those? (When pulled, there was huge release of creosote). But leaving the piles in place goes against the clean up goal.
Cap effective and stable? Preventing hydrocarbons from coming to the surface?

<u>From comment cards:</u>
"For such a difficult cleanup area, I think it is going remarkably well. I'm aware of most environmental problems and do what I can to help."

"I'm impressed by the work being done."

"EPA needs a cultural resource specialist!"

"1. Stream should be re-established on the surface.
2. Rip rap should be replaced or mitigated with various sizes intermediate cobble.
3. When will we know if "steam cleaning" will proceed and if so for how long?
4. Can the public access any portions of the beach? If so, how? Is there a procedure?
5. Several questions about intertidal areas—marine algae monitoring and observed changes (esp. Laminaria); cobble new formation on east side s. of steel wall.
6. Access to uplands for tree inventory
7. Preservation of historic buildings - supt.'s residence, a worker's residence? (NPS will be furious with you!)
8. Is funding assured to complete the cleanup? If not, how much funding is assured? Is there any chance this will not be completed?
9. Duration of pilot project?
10. I have an idea for a "mitigation" project if one is needed.

LIST OF DOCUMENTS REVIEWED

Community Involvement Plan Update, Wyckoff/Eagle Harbor Superfund Site, EPA, Nov. 2000
Integrated Risk Information System, IRIS Web Site, U.S. EPA
Washington State Department of Ecology Model Toxics Control Act Cleanup Regulation (173-340 WAC), February 2001
Washington State Department of Ecology Water Quality Standards for Surface Water of the State of Washington (173-201 WAC), November 1997

West Harbor Operable Unit

Record of Decision, EPA, September 1992
Record of Decision Amendment, EPA, December 1995
OMMP Annual Report for Year 0 (1997), Parsons Brinckerhoff, March 1998
Eagle Harbor WHOU Remedial Work Completion Report, de maximis inc., April 1998
Contingent Habitat Mitigation Screening Analysis, Herrera, June 2001
Year 4 (2001) Fourth Quarter Data Report and Annual Summary, Herrera, April 2002

East Harbor Operable Unit

On-Scene Coordinator's Report, EPA/USACE, September 1994
Record of Decision, EPA, September 1994
Operations, Maintenance, and Monitoring Plan, EPA, 1995
1995 Environmental Monitoring Report, Long-Term Monitoring Program, EPA, 1995
1997 Environmental Monitoring Report, EPA, 1998
Natural Recovery Study, LNAPL Flux Calculations, USACE, 1999
1999 Environmental Monitoring Report, EPA, 2000
Biological Assessment, USACE, July 2000
Design Analysis, Extended Sediment Cap, USACE, September 2000
Amended Water Quality Certification, EPA, October 2000
Natural Recovery of Persistent Organics in Contaminated Sediments at the Wyckoff/Eagle Harbor Superfund Site, Battelle, 2001
Addendum to Design Analysis, Phase 3 Extended Sediment Cap, USACE, October 2001
East Beach Intertidal Investigation Report, USACE, 2002

Soil and Groundwater Operable Units

Corrosion and Structural Evaluation at the Wyckoff Treatment Plant, CH2M Hill, January 1994
Design of Sheet Pile Walls, Engineering Manual (EM) 1110-2-2504, March 1994
Groundwater Extraction and Treatment Systems Assessment Technical Memorandum for the

Wyckoff/Eagle Harbor Superfund Site, CH2M Hill, April 1994
Interim Record of Decision, EPA, Groundwater Operable Unit, September 1994
Operations and Maintenance Manual, Sections 10 and 11, CH2M Hill (Draft), January 1995
Engineering Evaluation and Cost Analysis for Site Structures, CH2M Hill, April 1995
Interim Operations Plan, Groundwater Extraction System, CH2M Hill, March 1997
Technical Memorandum, Ground Water Treatment Plant Air Emission Characterization, Wyckoff/Eagle harbor Superfund Site, CH2M Hill, September 1997
Thermal Effects Study Management Plan, USACE, July 1999
Sheet Pile Drive Test Report, USACE, October 1999
Record of Decision, EPA, February 2000
Sampling and Analysis Plan, Wyckoff Facility and Groundwater Operable Units, Wyckoff/Eagle harbor Superfund Site, Prepared by URS Greiner in association with CH2M Hill, June 2000
Biological Assessment, USACE, July 2000
Design Analysis, Sheet Pile Containment Wall, USACE, September 2000
Amended Water Quality Certification, EPA, October 2000
Health and Safety Plan, Wyckoff Superfund Site, CH2M Hill, October 2000 Revision
Remedial Action Management Plan, Sheet Pile Installation, Habitat Mitigation Beach Construction, Wyckoff/Eagle Harbor Superfund Site, Prepared by Bay West, Inc. for Seattle District Corps of Engineers and EPA region 10, October 2000
Sheet Pile Hydraulic Conductivity Report, USACE, March 2001
Remedial Action Management Plan, Site Infrastructure Support, Wyckoff/Eagle Harbor Superfund Site, Prepared by Marine Vacuum Service, Inc. for Seattle District, Corps of Engineers and EPA Region 10, July 25, 2001
Design Analysis, Thermal Remediation Pilot Study, USACE, August 2001
Wyckoff Treatment Plant Monthly Operations Reports, CH2M Hill, Feb-Dec 1998; Sept. 2001
Wyckoff Treatment Plant Monthly Operations Reports, USACE, Jan-June 2002
Management Plan for Thermal Remediation Pilot Construction, Wyckoff/Eagle Harbor Superfund Site, Prepared by Pease Construction, Inc. for Seattle District, Corps of Engineers and EPA Region 10, February 2002
On-Site Water Supply Well Report, USACE, June 2002
Design Analysis Amendment, Thermal Remediation Pilot Study, August 2002

Five-Year Review Site Inspection Checklist

I. SITE INFORMATION	
Site name: Wyckoff/Eagle Harbor Superfund Site	**Date of inspection:** April 9, 2002
Location and Region: Bainbridge Island, WA Region 10	**EPA ID:** WAD009248295
Agency, office, or company leading the five-year review: EPA Region 10	**Weather/temperature:** Clear (50-55˚F)
Remedy Includes: (Check all that apply) **G**Landfill cover/containment **O**Access controls **O**Institutional controls **O**Groundwater pump and treatment **G**Surface water collection and treatment	**G**Monitored natural attenuation **O**Groundwater containment **O**Vertical barrier walls
GOther_____ _____	
Attachments:	**G**Inspection team roster attached / **G**Site map attached

II. INTERVIEWS (Check all that apply)

1. O&M site manager: Travis Shaw (Name) USACE Site Manager (Title) April, 9, 2002 (Date)
Interviewed **O**at site **G** at office **G**by phone Phone no. 206-764-3527
Problems, suggestions; **O** Report attached _____
_____

2. O&M staff: Cliff Leeper (Name) OMI Lead Operator (Title) April 9, 2002 (Date)
Interviewed **O**at site **G** at office **G**by phone Phone no. 206-780-1711
Problems, suggestions; **O** Report attached _____
_____

III. ON-SITE DOCUMENTS &RECORDS VERIFIED							
1.	**O&M Documents**						
	O&M manuals	x	Readily available	x	Up to date		N/A
	As-built drawings	x	Readily available		Up to date		N/A
	Maintenance logs	x	Readily available	x	Up to date		N/A
2.	**Site Specific Health and Safety Plan**	x	Readily available	x	Up to date		N/A
	Contingency plan/emergency response plan	x	Readily available	x	Up to date		N/A
3.	**O&M and OSHA Training Records**	x	Readily available	x	Up to date		N/A
	Remarks: First Aid, Respirator Fit Testing, HAZWOPER						
4.	**Permits and Service Agreements**						
	Air discharge permit		Readily available		Up to date	x	N/A
	Effluent discharge	x	Readily available	x	Up to date		N/A
	Waste Disposal, POTW		Readily available		Up to date	x	N/A
	Other permits		Readily available		Up to date	x	N/A
5.	**Gas Generation Records**		Readily available		Up to date	x	N/A
6.	**Settlement Monument Records**		Readily available		Up to date	x	N/A
7.	**Groundwater Monitoring Records**	x	Readily available	x	Up to date		N/A
8.	**Leachate Monitoring Records**		Readily available		Up to date	x	N/A
9.	**Discharge Compliance Records**	x	Readily available	x	Up to date		N/A
10.	**Daily Access/Security Logs**	x	Readily available	x	Up to date		N/A

IV. O&M COSTS					
1.	**O&M Organization**				
			State in-house		Contractor for State
			PRP in-house		Contractor for PRP
			Federal Facility in-house		Contractor for Federal Facility
			Other: With the exception of the West Harbor OU, this is an EPA fund-lead site, O&M services has been contracted directly by EPA or by the Corps of Engineers (under an IAG with EPA).		
2.	**O&M Cost Records**	x	Readily available		Up to date
		x	Funding mechanism/agreement in place		
		x	Funding breakdown attached		
	Total annual funding by year for review period if available (all 4 operable units)				
	Date		**Total Cost**		
	Year 1 (1998)		$1,045,000		Breakdown attached
	Year 2 (1999)		$1,320,000		Breakdown attached
	Year 3 (2000)		$1,085,000		Breakdown attached
	Year 4 (2001)		$1,276,000		Breakdown attached
	Year 5 (2002)		$1,459,000		Breakdown attached
3.	**Unanticipated or Unusual High O&M Costs During Review Period:**				

The treatment plant and the original extraction systems were constructed by the Wyckoff Company, the primary PRP in 1990. The PRPs selected construction materials that are not compatible with site contaminants and with the marine environment. In many cases, the materials were subject to degradation by contaminants being treated by the plant or suffered from corrosion due to the high salinity of upper aquifer groundwater. As a result, portions of the extraction and treatment system have required unusually high O&M costs to replace components either chemically degraded or corroded from contact with brackish influent groundwater.

V. ACCESS AND INSTITUTIONAL CONTROLS								
A.	**Fencing**							
	Fencing damaged	x	Location shown on site map	x	Gates Secured		N/A	
	Remarks: Fencing along the northwestern portion needs to be expanded. Completion of the Phase III cap, which created a connecting beach along the northwestern shore of the site along the sheet pile wall now makes this area accessible.							
B.	**Other Access Restrictions**							
	Signs or other security measures							
	Remarks: In addition to locked gates, Authorized Personnel Only and No Trespassing signs are posted at all access points. Signs warning about the danger associated with the consumption of fish and shellfish from the harbor and adjacent beaches are also prominently displayed around the site perimeter in multiple languages.							
C.	**Institutional Controls**							
1.	**Implementation and Enforcement**							
	Site conditions imply ICs not properly implemented				Yes	x	No	
	Site conditions imply ICs not being fully enforced				Yes	x	No	
	Type of monitoring:	On-site personnel monitor controls.						
	Frequency:	Daily						
	Responsible party/agency:	USACE						
	Contact:	Travis Shaw, Site Manager office:206-764-3527 / cell:206-915-8892						
	Reporting is up-to-date			x	Yes		No	
	Reports are verified by the lead agency			x	Yes		No	
	Specific requirements in decision documents have been met			x	Yes		No	
	Violations have been reported			x	Yes		No	
	Other problems or suggestions: Vandalism has been a constant problem, particularly graffiti. The demolition of the three abandoned houses south of the site (on the Wyckoff property) is anticipated to make the site less of an attractive feature for vandals.							
2.	**Adequacy**	x	ICs are adequate		ICs are inadequate			
	Remarks: As stated above, removal of the abandoned houses is expected to make the site less attractive to vandals and trespassers.							
B.	**Other Site Conditions**							
	Remarks: Surface drainage continues to be an issue during storm events, particularly since the installation of the sheet pile containment wall. Storm water issues have been aggravated by the removal of contaminated soil from the western portion of the site. Consolidation and stockpiling of the contaminated soil within the Former Process Area eliminated low areas that previously provided holding areas for storm water. The fencing around exclusion zones around the existing extraction wells needs to repaired to clearly delineate these areas.							

VI. VERTICAL BARRIER WALLS							
1.	**Settlement**						
			Location shown on map		x	Settlement not evident	
	Remarks: No evidence of settlement was noted during the 9-month warranty inspection conducted in May 2002.						
2.	**Performance Monitoring**						
	Type of monitoring: Approximately 3 months after installation of the sheet pile wall, a modified pumping test was conducted at the joint observation wells installed at 8 sheet pile joint locations along the sheet pile containment wall. In addition, the joint observation wells were checked for NAPL intrusion with an oil/water interface probe.						
	Frequency: The modified pumping test was scheduled for 3 months and 1 year after installation of the sheet pile wall. NAPL intrusion is monitored monthly with the interface probe.						
	Remarks: The conductivity of the wall was higher than anticipated during design but consistent with published data on other sheet pile walls using interlocking joints. It is anticipated that the interlock joints will continue to become less permeable over time due to clogging with fine soil particles.						
VII. GROUNDWATER REMEDY							
A	**Groundwater Extraction Wells, Pumps and Pipelines**						
1.	**Pumps, Wellhead Plumbing and Electrical**						
			Good Condition	x	All wells operating properly		Needs Maintenance
	Remarks: All existing extraction wells are operating normally. However, the pumps are nearing the end of their scheduled service life and will require rebuilding over the next 12 months.						
2.	**Extraction System Pipelines, Valves and other Appurtances**						
		x	Good Condition		Needs Maintenance		
	Remarks: None						
3.	**Spare Parts**						
			Readily Available		Good Condition	x	Requires Upgrade
	Remarks: The spare parts list needs to be expanded and upgraded to assure that critical parts are onsite in the event that an unanticipated failure that could result in the need to shut down the treatment plant. The O&M contractor has been tasked with identifying key components that could result in a shut down of the extraction system or the treatment plant and to develop a critical parts list. That list is nearing completion and acquisition of critical parts should be complete prior to the start of steam injection within the pilot area.						
B	**Surface Water Collection Structures**				Applicable	x	N/A

C	**Treatment System**						
1.	**Treatment Train**						
			Oil/water separation		Good Condition	x	Needs Maintenance
			Bioremediation	x	Good Condition		Needs Maintenance
			Carbon adsorbers	x	Good Condition		Needs Maintenance
			Additive (polymer)	x	Good Condition		Needs Maintenance
	Remarks: The oil/water separation system is in poor shape and is not functioning properly. This unit will be replaced with a new Dissolved Air Flotation (DAF) treatment unit in August 2002.						
2.	**Electrical Enclosures and Panels**			x	Good Condition		Needs Maintenance
3.	**Tanks, Vaults and Storage Vessels**				Good Condition	x	Needs Maintenance
	Remarks: Many of the tanks in the treatment plant have experienced accelerated rates of corrosion, which has reduced wall thickness in some of the large tanks and the two equalization tanks. Of particular concern is the old biofilter tank (T-205), which is used as a wet-well for the P-205 pumps. This tank is heavily corroded and is showing signs of structural degradation/instability. Current plans are for this tank to be replaced prior to the beginning of steam injection (Sept. 2002). Several of the tanks were also damaged during the Nisqually earthquake last year. Repairs to the effluent tank (T-303) were recently completed and work to clean, seal and re-secure the equalization tanks (T-401 and T-402) will begin in July 2002.						
4.	**Discharge Structure and Appurtenances**			x	Good Condition		Needs Maintenance
	Remarks: The section of the outfall pipe between the treatment plant pad and the sheet pile wall was replaced in December 2000. Approximately 20 feet of pipe was also replaced outside the containment wall due to corrosion. Based on the condition of the pipe exposed during these repairs, it is believed that the remaining section of the outfall extending offshore is in good condition. This assumption will be verified before August 30th 2002 by divers conducting sediment sampling as part of the outfall compliance monitoring event scheduled to occur prior to beginning steam injection in the pilot area.						
5.	**Treatment Buildings**			x	Good Condition		Needs Maintenance
	Remarks: Generally, the treatment buildings and trailers are in good condition. Over the last year, many of the deteriorating wooded stairways used to access site trailers were replaced with newer metal stairs. A new building was constructed this year to house the mechanical equipment and boiler required for the steam injection pilot study. In addition, a new pump house was constructed to enclose the new onsite water supply well.						
6.	**Monitoring Wells**						
	Remarks: The condition of the monitoring wells onsite varies considerably. Several are heavily fouled or have degraded due to materials of construction incompatible with site contaminants. Conversely, several of the newer wells installed onsite appear to be in good condition. Currently, monitoring wells are only routinely sampled to determine water levels. This data is used to confirm that hydraulic control is being maintained by the existing liquid extraction system. Prior to beginning steam injection, both upper and lower aquifer wells will be sampled to establish a contaminant baseline. Since all but two monitoring wells are within the fence securing the Former Process Area, individual wells do not have locking well caps. Recent remedial actions outside the perimeter of the Former Process Area have increased access to the two wells outside the fenced portion of the site. Locking well caps should be acquired for these two wells (MW-23 and CW01).						

D	**Monitoring Data**				
1.	Monitoring Data	x	Is routinely submitted on time	x	Is of acceptable quality
	Remarks: Compliance and performance samples for operation of the existing groundwater treatment plant are collected by the O&M contractor and shipped to the Region 10 Laboratory at Manchester for analysis on a weekly basis. Preliminary data is reported by the laboratory within the same week to provide the plant operators with timely information regarding effluent discharge chemistry. Final data packages, including a Data Quality Assurance Report are submitted to USACE approximately 30 days after sample collection. Since USACE assumed oversight of the existing groundwater treatment plant, there have been no significant data quality issues.				
2.	Monitoring Data Suggests	x	Groundwater plume is effectively contained		Contaminant concentrations are declining
	Remarks: Evidence for effective containment is provided by the monthly groundwater level measurements. Based on this data, the hydraulic control has been maintained across the Former Process Area. Indications are that pumping from the existing extraction system is sufficient to induce an inward gradient within the contaminated upper aquifer both vertically and horizontally. The level of hydraulic control is further supported by the presence of the sheet pile wall, which provides a physical barrier to both NAPL and dissolved-phase contaminant migration from the Former Process Area to Puget Sound and Eagle Harbor. Contaminant concentrations in groundwater are not declining due to several factors. First, installation of the sheet pile wall provides a physical barrier that prevents the intrusion of seawater into the upper aquifer during high tides. Consequently, less mixing of groundwater is occurring, which has reduced the dilution of contaminated groundwater. Secondly, the presence of a physical barrier has potentially increased the efficiency of the existing wells in capturing both contaminated groundwater and NAPL. This is indicated by the increase in contaminant concentrations in groundwater and increased NAPL recovery over the last 9 months.				